INVESTIGATING CROWD DELIVERY BUSINESSES FOR SUSTAINABILITY

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ETHICAL DECLARATION

I hereby declare that I am the sole author of this thesis and that I have conducted my work in accordance with academic rules and ethical behaviour at every stage from the planning of the thesis to its defence. I confirm that I have cited all ideas, information and findings that are not specific to my study, as required by the code of ethical behaviour, and that all statements not cited are my own.

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Date: 06.07.2023

Signature:

ABSTRACT

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The way businesses run their operations and how their customers shop are both being transformed rapidly and constantly by technology. The traditional last-mile delivery method is being replaced by innovative approaches as sales techniques evolve. Businesses are conscious that, to remain competitive they must keep up with these changes and be sustainable at the same time. In response to these requirements, the idea of "crowd delivery," the focus of this thesis, has emerged. This thesis aims to advance crowd delivery businesses' sustainability by employing a qualitative methodology as it is a novel academic and business field. The "Stakeholder Theory" is chosen as the theoretical framework while employing a multi-method approach with an emphasis on the interactions between multiple actors. To comprehend what has been investigated about crowd delivery and what has not, as well as to identify its sustainability benefits and risks, a systematic literature review is conducted. For companies and stakeholders separately, sustainability features are categorized under the three pillars of sustainability and research gaps are identified. Using both findings, the semi-structured interview questionnaire is developed. 13 participants from both the

supplier and the company sides are chosen using purposeful and snowball sampling methods. In order to better understand how crowd delivery businesses are operating in regard to the three pillars of sustainability, literature and interviews content analysis are compared to identify validated, transformed, and new benefits and risks. Finally, propositions are offered to increase crowd delivery businesses' sustainability to add to the literature and give managers perspectives.

Keywords: Logistics, Last Mile Delivery, Crowd Delivery, Sustainability.

ÖZET

KİTLE DAĞITIMI İŞLETMELERİNİN SÜRDÜRÜLEBİLİRLİKLERİNİN ARAŞTIRILMASI

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İşletmelerin faaliyetlerini yürütme ve müşterilerinin alışveriş yapma biçimleri teknoloji tarafından hem hızla hem de sürekli olarak dönüşüyor. Satış teknikleri geliştikçe, geleneksel son kilometre teslimat yönteminin yerini yenilikçi yaklaşımlar alıyor. İşletmeler, rekabetçi kalabilmek için bu değişimlere ayak uydurmak ve aynı zamanda sürdürülebilir olmak zorunda olduğunun bilincindedir. Bu gereksinimlere yanıt olarak, bu tezin odak noktası olan "kitle dağıtımı" fikri ortaya çıkmıştır. Bu tez, yeni bir akademik ve iş alanı olduğu için nitel bir metodoloji kullanarak kitle teslimat işletmelerinin sürdürülebilirliğini geliştirmeyi amaçlamaktadır. Çoklu aktörler arasındaki etkileşimlere vurgu yapan ve çoklu yöntem yaklaşımı kullanılırken teorik çerçeve olarak "paydaş teorisi" seçilmiştir. Kitle dağıtımı hakkında neyin araştırıldığını ve neyin araştırılmadığını anlamak, sürdürülebilirlik faydalarını ve risklerini belirlemek için sistematik bir literatür taraması yapılmıştır. İşletmeler ve paydaşları için ayrı ayrı, sürdürülebilirlik özellikleri üç sürdürülebilirlik sütunu altında kategorize edilmiş ve araştırma boşlukları belirlenmiştir. Her iki bulgu kullanılarak

yarı yapılandırılmış mülakat soruları geliştirilmiştir. Hem tedarikçi hem de işletme tarafından 13 katılımcı, amaçlı ve kartopu örnekleme yöntemleri kullanılarak seçilmiştir. Kitle dağıtım işletmelerinin sürdürülebilirliğin üç ayağı açısından nasıl çalıştığını daha iyi anlamak için, doğrulanmış, dönüştürülmüş ve yeni fayda ve riskleri belirlemek için literatür ve mülakat içerik analizi karşılaştırılmıştır. Son olarak, kitle dağıtım işletmelerinin sürdürülebilirliğini artırmak için literatüre eklenecek ve yöneticilere bakış açısı kazandıracak öneriler sunulmuştur.

Anahtar Kelimeler: Lojistik, Son Kilometer Teslimatı, Kitle Dağıtımı, Sürdürülebilirlik.

Dedicated to my loving husband Ali Erhan İzcan and our two lovely daughters Eliz İzcan and Zeynep İzcan for their love and patience during my studies.

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PREFACE

My interest in innovation management and sustainability and desire to contribute to the literature led me to examine the novel topic of Crowd Delivery. During the thesis process, I gained in-depth knowledge on Last Mile Delivery and Crowd Delivery practices and improved myself academically.

This thesis targets Crowd Delivery managers by providing them information that will help them add value to theis novel delivery model.

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Elif İzcan

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BM: Courier Company Branch Manager

C: College

CC: Crowd Courier

CCHF: Courier Company with Hybrid Fleet

CCSC: Crowd Courier Supplier Company

CD: Crowd Delivery

CDC: Crowd Delivery Company

CDSP: Crowd Delivery Service Provider

E-CDC: E-retailer Crowd Delivery Company

ECDC: Express Crowd Delivery Company

HS: High School

LMD: Last mile delivery

LSP: Logistic Service Provider

PRISMA: Preferred Systematic Reviews and Meta-Analysis

RO: Research Opportunity

RQ: Research Question

SLR: Systematic Literature Review

SSCM: Sustainable Supply Chain Management

U: University

USH: Urban Short Haul

CHAPTER 1: INTRODUCTION

1.1. Introduction to the Thesis

In recent years, Internet has become more widely used and has expanded into more fields, so that retailing can now be done through online e-commerce platforms anywhere in the globe. The data shows that e-commerce sales peaked in 2017 at $2,382 billion USD, increased to $5,211 billion USD in 2021, and are expected to reach up to $7,528 billion USD by the year 2025 (Chevalier, 2022).

Consumers may now shop for the products they want or need from the convenience of their own homes thanks to e-commerce. End users shop online at e-commerce websites rather than going to physical stores. Consequently, the way goods circulate has undergone a spectacular change as a result.

Additionally, as e-commerce volumes have expanded over the past few years, there has been a significant and unavoidable increase in freight transportation while the products arrive at the doorstep of the end user.
"Last mile delivery" refers to the stage of a freight shipment where packages arrive at their final destination (Dupljanin et al., 2019). Typically, traditional courier services handle this part of shipments through the practice of having their personnel drive motorized corporate vehicles.

Despite its convenience, traditional last mile delivery causes high fossil fuel use, traffic and noise, which have negative impacts on the society and the environment (Buldeo Rai et al., 2017). Furthermore, economically, it can account for up to 75% of all supply chain expenses (Devari, Nikolaev and He, 2017).

Crowd delivery emerged as a solution, enabling efficient use of available resources, as businesses tried to apply creative methods to delivery operations in reaction to these undesirable effects (Castillo et al., 2018).

This new paradigm is known by several other names in the literature, including crowdsourced last mile, crowdshipping, crowd-delivery, etc. In any instance, the

model's reasoning is based on the setting of crowdsourcing. The last mile delivery task is a prime example of crowdsourcing, an internet-enabled approach that employs online platforms as a medium to actualize requested tasks. In the absence of an employment contract, individuals provide their resources and skills to requesters in exchange for remuneration. Temporary ownership of the means of the common people leads to efficient use of the available resources, resulting in economic savings, environmental protection, and social advancement.

1.2. Introduction to the Research Problem and Aims of the Thesis

The phrase "crowd" as its entirety is developed under the umbrella term "crowdsourcing" (Voigt and Kuhn, 2021). Jeff Howe first used the phrase "crowdsourcing" in his article that appeared in Wired Magazine in 2006. He defines the phenomenon as the more economically feasible fulfilment of professional responsibilities by individuals rather than by corporate members. The "crowd" refers to the people who carry out these responsibilities (Howe, 2006).

Crowd delivery basically makes use of people's dedicated trips to decrease the negative effects of last mile delivery compared to traditional last mile delivery (Buldeo Rai et al., 2017). It makes the case that it is more economically feasible due to lower prices, socially effective due to the creation of new jobs, and ecologically beneficial compared to the dedicated trips made by traditional delivery. In essence, businesses or individuals crowdsource their delivery needs to the public who are available to do so (Buldeo Rai et al., 2017). Crowd delivery is, however, criticized for having risks as well.

It is important to emphasize that this is an innovative concept. Crowd delivery just became operational in 2012 (Shen and Lin, 2020). Furthermore, Walmart and DHL only started testing out and piloting crowd delivery in 2013 (Macrina et al., 2020). Crowd delivery (CD), is also mentioned in the literature as an emerging field (Huang et al., 2020). However, CD practices are becoming prevalent. Both consumers and businesses favor it more and more as a delivery method. Typically, large corporations (like Amazon and DHL) or startups (like Deliv and Postmates) build CD platforms. Furthermore, shipping companies are increasingly adopting the crowdsourcing

concept and forming hybrid fleets. The reason of this is that CD provides flexibile participants, a cost-effective and friendly operating system, and effective distribution (Bin et al., 2020). These benefits could be interpreted as a sign that crowd delivery will become increasingly common.

As a result, it is engaging to conduct an extensive study on a new and widely used business concept. This study intends to investigate the sustainability benefits and risks of prevaling CD businesses as well as putting forth new benefits and risks for improving their sustainability.

Consequently, two research questions in the following section are formed as a result of the thesis's objectives.

1.3. Research Question of the Thesis

Below are the research questions (RQs) that serve as the foundation for this thesis.

RQ1: What are the research opportunities in crowd delivery business area?
RQ2: How crowd delivery businesses can be improved towards the three pillars of sustainability?

Research questions of this thesis is answered within the framework of Stakeholder Theory, using a multi-method approach consisting of systematic literature review (SLR) and semi-structured interview.

Stakeholder Theory is considered to be a suitable framework for answering the research questions of this thesis, as this theory is built to understand and classify factors, with a focus on connections between actors and formation of perspectives and as being an accepted scope of theory in Sustainable Supply Chain Management literature (Govindan and Bouzon, 2018).

To answer RQ1 and RQ2 systematic literature review method is applied. Findings of systematic literature review are used to identify the research gaps in crowd delivery topic and reveal the research opportunities.

To further answer RQ2, semi-structured interview method is applied. Semi-structured interview questions are developed subsequently during the systematic literature review coding and research gaps identification process. Thirteen participants from the field are (ten from supplier side and 3 from company side), thoroughly questioned on the sustainability benefits and risks of crowd delivery businesses, to gain further insight and compare the literature review findings. Purposeful and snowball sampling is applied to determine semi-structured interview participants from supplier side and company side.

Systematic literature review findings, semi-structured interviews with suppliers and company representatives findings are used to triangulate the data on the sustainability benefits and risks of crowd delivery businesses. Triangulation resulted in highlighting validated, transformed and new findings to the literature, aimed at better understanding how crowd delivery businesses are currently performing redarding the three pillars of sustainability and making propositions to improve their sustainability.

CHAPTER 2: THEORETICAL FOCUS AND THEORETICAL FRAMEWORK

The concepts included in this thesis related to last mile delivery, crowd delivery as well as sustainability pillars and theoretical framework in which the research is based, and their relevance with the thesis are presented in this section.

2.1. Theoretical Focus of the Thesis

This thesis covers a wide range of management and business themes. Definitions of these concepts; e-commerce, last mile delivery, crowdsourcing, crowd delivery, and sustainability are presented in this section.

2.1.1. E-Commerce and Last Mile Delivery

Electronic commerce, commonly known as e-commerce, is an indisputable reality of today. It involves the trading of goods and services via the Internet (Kwilinski et al., 2019). E-commerce provides firms with a great chance to increase revenue (Kwilinski et al., 2019). Global retail e-commerce sales reached approximately 5.2 trillion US dollars in 2021 and are expected to reach about 8.1 trillion dollars by 2026 (Chevalier, 2022).

According to these statistics, business-to-consumer (B2C) e-commerce is gaining momentum and the challenges that it poses to logistics management are essential to company service levels (Mangiaracina et al., 2019).

Last mile delivery (LMD) is the final stage of delivery in B2C distribution by which consignments reach consignees at their given address or at a pick-up point. The rise in e-commerce places a huge burden on LMD volumes, complicating their management (Tiwapat, Pomsing and Jomthong, 2018).

LMD is especially important because it is the final leg of shipment and is required for order fulfillment; also, it is a very expensive logistics activity that costs between %13 and 75% of total supply chain costs (Tiwapat, Pomsing and Jomthong, 2018). Online customers are quite demanding when it comes to receiving their products on time. E-

commerce order performance and service level are heavily reliant on LMD performance (Mangiaracina et al., 2019).

LMD traditionally is handled by third-party logistics operators, with home deliveries made by vehicles (Mangiaracina et al., 2019). This typical LMD not only affects economic sustainability with its excessive cost, but it also creates social and environmental bottlenecks by generating traffic, noise, air pollution, and other externalities (Tiwapat, Pomsing and Jomthong, 2018).

Businesses seek innovative means of LMD to obtain an advantage in the extremely competitive e-commerce market (Mangiaracina et al., 2019). In such a competitive environment, LMD innovations to improve financial and operational efficiency are critical (Tiwapat, Pomsing and Jomthong, 2018). LMD solutions are numerous and continue to evolve to this day.

According to, Gevaers et al. LMD modes as; reception box, collection point, post office, attended home delivery, and unattended home delivery (Gevaers et al., 2011). According to Tiwapat et al., emerging trends include smartphone applications, smart reception boxes, drones, and crowdsourced last mile delivery (Tiwapat, Pomsing and Jomthong, 2018).

The subject of this thesis, crowdsourced LMD mode, is explored in detail in the following section.

2.1.2. Outsourcing and Crowdsourcing

Jeff Howe coined the phrase "crowdsourcing" in his 2006 Wired Magazine article (Howe, 2006). His work defined a new phenomena in practice and introduced the term "crowdsourcing", a business approach that he described to be quite similar to outsourcing. Nevertheless, he drew a line between these two phenomena in his paper titled "The Rise of Crowdsourcing."

In general, outsourcing means that a company acquires material and service inputs from a third party (Troaca and Bodislav, 2012). In other words, it is characterized as a

company subcontracting some of its previously internal functions to a specialist outside company (Digout et al., 2013). In contrast, in crowdsourcing, tasks or duties are assigned to a crowd of people through an open call on the internet, with the identity of the individuals unknown (Digout et al., 2013). The logic behind the usage of the word "crowd" in the new term "crowd-sourcing" makes perfect sense from this perspective.

Both phenomena are similar in their goals, which are to save on money and human resources (Digout et al., 2013). Crowdsourcing allows businesses to engage professionals, retirees, amateurs, and other individuals without the need for a standard subcontracting agreement. In comparison to outsourcing, the absence of such an agreement saves them costs (Howe, 2006).

In their 2012 work, Estelle's-Arolas and Gonza'lez-Ladro'n-de-Guevara created an integrated definition of "crowdsourcing" after evaluating 209 articles from six databases with 40 original definitions. Their approach is based on defining three major components of crowdsourcing, namely the crowd, the initiator, and the process, and it is as follows;

> *"Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage what the user has brought to the venture, whose form will depend on the type of activity undertaken."* (Estellés-Arolas and González-Ladrón-De-Guevara, 2012, pp. 189–200).

As the name implies, the initiator, also known as the crowdsourcer, request the crowd's

tangible or intangible resources, such as knowledge, creativity, money, or experience, for its own use and benefit, and the crowd provides its resources in exchange for a tangible or intangible gain. Because the input, output, and process of crowdsourcing vary, the phenomenon's typology must be addressed further here.

The work of Ali-Hassan and Allam in 2016 to categorize crowdsourcing initiatives yielded 13 types; crowdsourcing, open innovation, user innovation, open-source software, crowdsharing, crowdvoting, crowdnetworking, crowdpedia, scisourcing, ideation, crowdfunding, and crowd-relief (Ali-hassan, 2016).

To acknowledge crowdsourcing characteristics, some short definitions are provided below.

User innovation, for example, refers to organizations that leverage end-user intelligence and knowledge to improve their goods or services. Companies such as Starbucks and ProctorandGamble leverage creative ideas from recommendation feedback from their customers to better their market position. *Crowdsharing* is the online distribution of media information or knowledge by crowds. Sharing media content on YouTube, Twitter, or ehow.com, for example. Another is crowdfunding, in which individuals fund entrepreneurial endeavors through donations (Ali-hassan, 2016). Kickstarter is a well-known example of such a website.

In exchange for their contributions toward the goals of the crowdsourcing systems, the crowd receives social recognition, altruism, charity, or monetary rewards (Ali-hassan, 2016). For the initiators, the crowd provides value, greater profits, or innovations (Estellés-Arolas and González-Ladrón-De-Guevara, 2012).

Ali-hassan refers to one of the 13 categories as *crowdsourcing* and defines it as: completing simple routine activities in exchange for micropayments, undertaken by the general public because it requires little skill, and completed within a certain deadline. As frequently seen in the literature, Ali-hassan illustrates Amazon's Mechanical Turk crowdsourcing initiative, in which a big population of individuals execute simple online activities such as transcription of podcasts or keyword labeling

of photographs in exchange for minimal compensation.

Crowd delivery, on the other hand, is the use of crowdsourcing for last-mile delivery. Individuals that perform freight deliveries make up the crowd herein. They can be amateur or professional drivers who make trips and offer transportation services through crowd delivery service provider initiatives (Voigt and Kuhn, 2021).

2.1.3. Crowd Delivery

During the recent e-commerce boom, supply chain management underwent a transition in inventory and distribution planning (Castillo et al., 2018).

Since e-commerce purchases are small parcels with multiple destinations, their LMDs (Last Mile Delivery) are the most expensive for supply chains. Online customers' grand expectations, such as quick or even same-day delivery, necessitate tight processes. Companies are turning to more efficient methods of meeting customers' expectations in the changing world of purchasing. Due to the high operational costs of LMD operations, various distribution methods such as parcel lockers, drones, and crowd delivery have emerged (Seghezzi et al., 2021). Chain of causality is visualized in Figure 1.

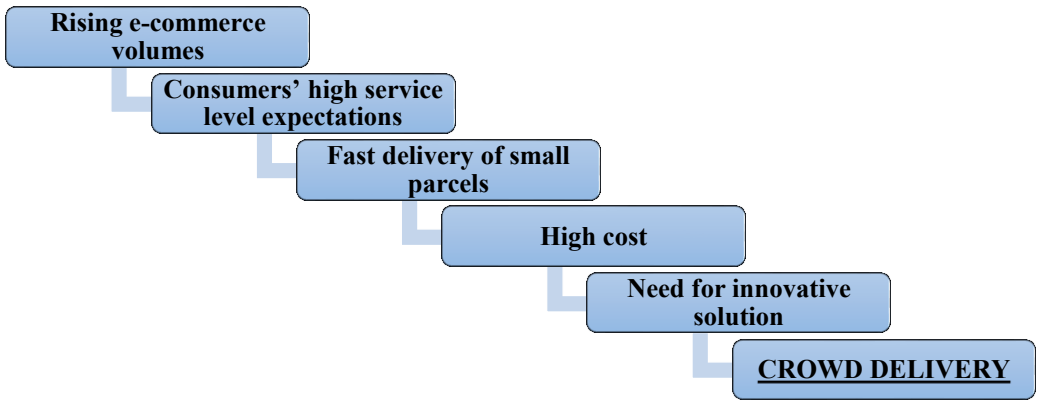


Figure 1. Chain of causality leading to crowd delivery

Our primary interest crowd distribution the method incorporates sharing economy components since it makes use of idle or accessible resources. CD makes use of

transportation capacity of individuals without ownership. Rather it takes adventage of temporary ownership to reduce investment and operating cost. Reduced costs in return benefit the financial figures of supply chain operations (Castillo et al., 2018).

CD is classified as a subcategory of crowdsourcing because it occasionally makes use of individuals' transportation capabilities in exchange for minimal remuneration per task or distance traveled (Behrend et al., 2019). Instead of hiring full-time couriers and investing in vehicles to fulfill LMDs, CD offers an asset-light business model for completing the last leg of e-commerce shipments (Buldeo Rai et al., 2017).

Companies that use CD optimize their resource allocation, boost their efficiency, improve delivery speed, elevate their service level, and raise customer satisfaction (Wang and Xie, 2021b).

In CD, companies typically call for occasional, non-professional couriers, herein the crowd, through an open call using internet technologies reciprocating small compensations (Seghezzi et al., 2021). Unlike traditional full-time courier employment contracts, crowd payment is generally organized as per-delivery or per-mileage rates (Castillo et al., 2022).

The first type incorporates the delivery task into his or her pre-planned trip, while the second type arranges his or her trip to intentionally realize the delivery task (Cheng et al., 2022).

Delivery orders and crowd couriers are called and matched digitally via software through online crowd delivery platforms (Zehtabian, Larsen and Wøhlk, 2022). The platforms' technological infrastructure is web or smart phone based, and implemented algorithms match demand and supply (Buldeo Rai et al., 2017). The demand in this case is the task requesters, and the supply is the crowd couriers who are eager to take on these tasks. Senders and receivers of the deliveries can either be individuals or businesses (Le and Ukkusuri, 2019).

Crowd delivery service providers are mainly grouped as e-retailers having their crowd

delivery initiatives and crowd delivery platforms (Alnaggar, Gzara and Bookbinder, 2021). Amazon Flex, a well-known example of an e-retailer CD provider, was established in 2015 to perform Amazon's LMDs (Zehtabian, Larsen and Wøhlk, 2022). Another notable example is Walmart's, Spark Delivery initiative (Alnaggar, Gzara and Bookbinder, 2021).

CD activities by e-tailers exclusively serve their parent firm. Whereas CD platforms such as Roadie and PiggyBee provide pick-up and delivery for any retalier that the recipient requests. Restaurants and grocery stores, in addition to merchants, can offer home delivery via CD platforms such as Uber Eats and Instacart (Mittal et al., 2021). Individuals, businesses, or both can be the target market for CD projects, such as Hitch, Roadie, and Postmates consecutively (Alnaggar, Gzara and Bookbinder, 2021).

In the corporate realm, there are also CD delivery partnerships. Retailers collaborate with CD platforms to provide faster or even same-day delivery, such as Walgreens' collaboration with Postmates, The Home Depot's collaboration with Roadie, and Target's collaboration with Shipt (Castillo et al., 2021).

Furthermore, it is worth noting that CD is primarily used for short-distance, local, urban deliveries. Nonetheless, there are a few projects, such as Truxx and Uber Freight that deliver large items over long distances (Alnaggar, Gzara and Bookbinder, 2021). Furthermore, it is important emphasizing that the CD market includes more than just e-retailers and CD platforms. During 2013, the well-known shipping company DHL also conducted a prototype crowd delivery experiment named DHL MyWays in Stockholm (Pourrahmani and Jaller, 2021). Crowds were able to pick up parcels from DHL branches and deliver them to recipients as part of this operation (Alharbi, Cantarelli and Brint, 2022).

Finally, there is the hybrid fleet approach to LMDs, which combines a privately owned fleet alongside crowdsourced assets (Castillo et al., 2021).

2.1.4. Sustainability: From Sole Economic Growth to Three Pillars of Sustainability

Historically, the concept of exploitative "economic growth" has governed the world's countries. Economic expansion prioritized national economic progress over societal needs and concerns (Johnston et al., 2007). The narrow perspective of this obsolete strategy ignores the effects of economic activity on the environment and society (Lozano, 2008).

"Sustainable development" emerged as an alternative early in the shift away from traditional. The Union for Conservation of Nature, the United Nations Environmental Program, and the World Wildlife Fund published the "World Conservation Strategy" in 1980 expressing this notion. Herein, economic development goals are considered to fall short if limited resources and ecological carrying capacity are not taken into account (Purvis, 2019).

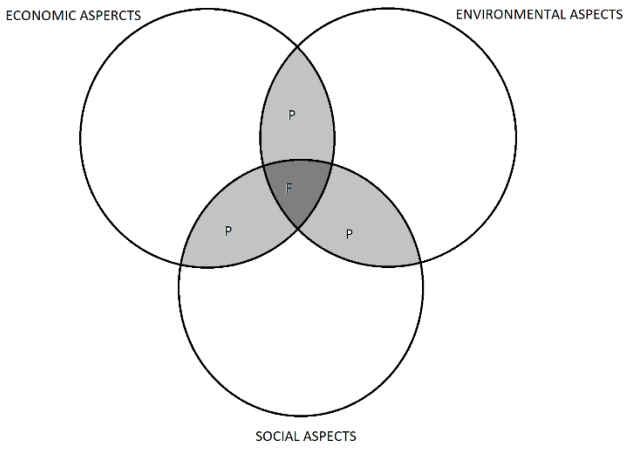
In the 1987 Brundtland Report, the United Nations provided an alternative to the existing approach as "…development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Since the 1990s, the transition has been taking its course (Johnston et al., 2007).

As a result of recent improvements in human civilisation, global population growth has reached unprecedented levels. As a result, consumption has skyrocketed, threatening the vital economic, environmental, and social quality of life for both current and future generations (Lozano, 2008). Given these concerns, it appears unavoidable that the appropriate steps be taken to preserve the balance utilizing a linked triple strategy in order to survive in the long run.

As a result, ideas such as economic prosperity and social and environmental well-being came to be viewed as interconnected and necessary. They are claimed to be connected in the shape of a three-legged stool. In today's society, each leg of the stool is necessary, and neither should be sacrificed for the sake of the other(s).; rather, they should all support one another (Vos, 2007).

As we transition from the word "sustainable development" to the term "sustainability," it is important to note that they are commonly used interchangeably but have different meanings. The ability to reach the ultimate goal of sustainability is dependent on the commitment of each individual or organization to sustainable development. The contrast is that "sustainable development" is the strategy, path, and technique for achieving "sustainability" as the end goal (Martin et al., 2007).

The three-legged stool structure is commonly represented by a Venn diagram of three itersecting circles (Purvis, 2019). Seuring and Müller define sustainable supply chain management as regulating the flow of material, information, and capital as well as collaboration between business entities along the supply chain while taking into account objectives from all three dimensions of sustainable development—economic, environmental, and social—which are derived from customer and stakeholder requirements (Seuring and Müller, 2008).



P: Partial integration, F: Full integration

Figure 2. Sustainability Venn diagram (Source: Lozano, 2008).

Overall, as illustrated in Figure 2, the path toward full sustainability requires achieving economic prosperity, environmental preservation, and social well-being all at the same time (Lozano, 2008).

As a result, when examining the present and future of organizations from a business perspective, we can claim that all three variables should be given equal weight in order

to construct a more successful and long-lasting structure in the current world.

2.1.5. Introduction to Crowd Delivery Sustainability Benefits and Risks

According to United Nations 2018 projections, by 2050, 68% of the world's population, up from 55% at the time, is expected to live in urban areas. Furthermore, studies show that e-commerce is increasing at a 7.3% yearly rate on average (Nieto-Isaza, Fontaine and Minner, 2022).

The continued expansion of the e-commerce sector has resulted in an exceedingly quick increase of online orders. Not only do e-commerce websites offer internet shopping and home delivery to their customers, but so do grocery stores and restaurants (Mittal et al., 2021).

Demand for urban package delivery has risen dramatically as a result of simple access to internet shopping. Because of package transportation, traditional urban logistics are under a lot of strain, and logistics firms find it difficult to strike a balance between the speed of transportation and the cost of making urban package deliveries, as an increase in quantities and need for speed entails more personnel, more vehicles, and more frequent deliveries, which results in an increase in costs, urban traffic, and air pollution, which causes economic, social, and environmental issues (Cheng et al., 2022).

Crowd delivery is a new way for overcoming the difficulties caused by increased demand for urban last mile delivery services (Nieto-Isaza, Fontaine and Minner, 2022). CD is a promising response to companies' ever-increasing tension between product delivery speed and cost. CD proposes a low-cost, efficient, and environmentally and socially conscious urban package transit system (Cheng et al., 2022).

Crowd delivery is an appealing business model because it requires minimal assets and saves organizations cost. Aside from that, it benefits society by providing work for regular individuals. It also provides a greener option for LMD operations. It does, however, carry certain risks in addition to all of the benefits for the three sustainability pillars.

There are financial concerns for CD businesses, the crowd, and consumers. Trying to maintain a critical mass of customers and crowds is an issue for businesses. They face the risk of encountering supply and demand imbalances (Wang and Xie, 2021a).

Crowd bears the risk of potential price exploitation (Voigt and Kuhn, 2021). Consumers are concerned about mishandled and damaged deliveries, particularly by non-professional crowd couriers (Bin et al., 2021). CD raises safety, security, and liability issues, as well as an increased likelihood of privacy issues and criminal activities (Buldeo Rai et al., 2017). CD parcel pick-up and delivery should ideally be integrated into the crowd's pre-planned routes, making the concept more eco-friendly (Voigt and Kuhn, 2021). Nonetheless, modal choice, as well as planned and additional trips, risk having a negative impact on the environment (Buldeo Rai, Verlinde and Macharis, 2018). Monetary rewards for the crowd and consumers risk attracting more CD orders, resulting in more distance traveled, adding to already existing urban traffic and pollution (Devari, Nikolaev and He, 2017).

It is common sense that businesses must be economically sustainable in order to continue operations. Nonetheless, developing sustainable cities is a contemporary concern for the environment and society. CD is a unique business model that offers full sustainability in LMD - economic, environmental, and social.

The literature is becoming increasingly interested in the CD problem, and there is research, albeit few, aimed at achieving sustainability in aspects other than economics, which set the path for our study.

2.2. Theoretical Framework

In terms of theoretical framework, this thesis is grounded in the “Stakeholder Theory”, since it allows us to understand and classify factors, with a focus on connection between actors and formation of perspectives. It is also taken into account that it is an accepted scope of theory in Sustainable Supply Chain Management (SSCM) literature (Govindan and Bouzon, 2018).

The importance of stakeholders in corporate decision-making is growing and it is

believed that to create value in a sustainable and ethical manner, managers must balance the interests of many stakeholders (de Gooyert et al., 2017).

Stakeholder Theory serves as a framework for understanding and resolving three interconnected business issues: the need to connect ethics and capitalism, the need to understand how value is created and traded, and the need to assist managers in managing in a way that addresses the first two issues (Parmar et al., 2010). According to the Stakeholder Theory, we will have a greater chance of solving these three issues if we use the interactions between a business and the groups and individuals that it may affect or that are affected by it as a unit of analysis (Parmar et al., 2010). Stakeholder relationship management helps businesses to survive and it is also an ethical undertaking since it involves considerations of values and potential negative and positive effects of business to a wide range of groups and individuals (Parmar et al., 2010). Firms have primary and secondary stakeholder in its relationship with groups and individuals as presented in the Stakeholder Theory diagram in Figure 3 (Freeman, Harrison, and Wicks, 2007). Primary stakeholders include customers, employees, suppliers, financiers and communities and secondary stakeholders include competitiors, government, media, special interest groups and consumer advocate groups.

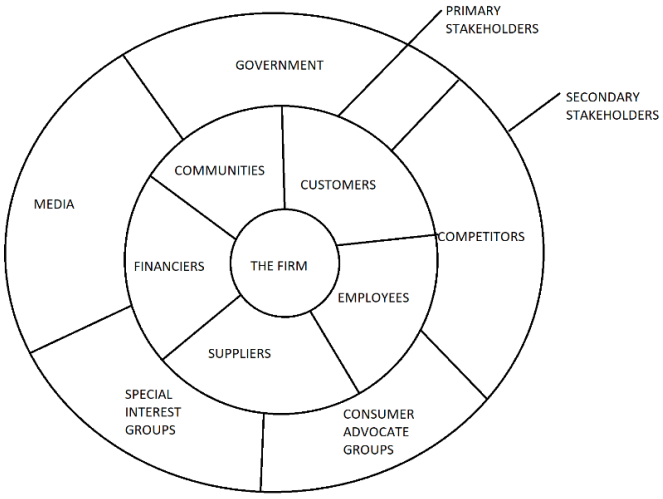


Figure 3. Stakeholder Theory diagram (Source: Freeman, Harrison and Wicks, 2007).

The adoption of sustainable last-mile logistics solutions depends heavily on stakeholders (Tolentino-Zondervan, Bogers and van de Sande, 2021). Whether or not

sustainability in the supply chain is promoted or avoided depends on the company's stakeholders (Govindan and Bouzon, 2018). In this thesis, we deploy Stakeholder Theory because CD is a novel last mile delivery model and its sustainability in three pillars is dependent on its stakeholders. CD primary stakeholders are revealed from the literature as customers, business or individual, and crowd couriers. Suppliers in CD business setting refers to crowd couriers.

This study explores the literature in a systematic manner to identify economic and social benefits and risks for companies, customers and crowd couriers as well as environmental benefits and risks of CD for the society. This research also includes a field research by which sustainability benefits and risks of CD are provided from crowd couriers and crowd delivery cargo branch managers.

Content analysis of literature and field interviews provided to validate the data in the literature and reveal novel benefits and risks of sustainability of crowd delivery businesses economic, social and enviromnental risks and pave the way for alignment of and remedy to stakeholder concerns.

In conclusion, Stakeholder Theory is utilized in this research to build up better relationships between the firm and its stakeholders, furthermore to provide ground and opportunity to create value and avoid ethical failures for CD businesses.

CHAPTER 3: METHODOLOGY

This study utilizes qualitative methodology, since applying crowdsourcing to last mile delivery operations is an emerging field of business and academic subject, there are very few research on this specific topic, and the investigation of different actors and their diverse perspectives on procedures and interactions, necessitates a qualitative methodology (Adeoye-Olatunde and Olenik, 2021).

Research process with the use of Stakeholder Theory is undertaken by a similar sequence to Govindan and Bouzon's 2018 study (Govindan and Bouzon, 2018). Starting with collection of material from the literature, which we have done by SLR to grasp benefits and risks of crowd delivery, continued with clustering benefits and risks under three pillars of sustainability, then classifying the clusters per stakeholders' perspectives.

We carried on to further material collection from the field to confront the previous literature, add to the body of knowledge and come up with suggestions for business model improvement.

3.1. Methodological Flow of the Thesis

Using a multi-method approach that includes systematic literature review (SLR) and semi-structured interviews, the research issues of this thesis are addressed within the context of Stakeholder Theory. Stakeholder Theory is considered to be appropriate for responding to the research questions of this thesis because it is designed to understand and categorize factors with a focus on connections between actors and the formation of perspectives and because it is a widely accepted theory in the literature on Sustainable Supply Chain Management (Govindan and Bouzon, 2018).

The systematic literature review approach—the first method employed in this thesis—is carried out in accordance with the key stages of a SLR as described in Pati and Lorusso's 2018 study using the PRISMA criteria (Pati and Lorusso, 2018).

We conducted a thorough, systematic literature review, extracted, classified, and coded

crowd delivery benefits and risks under the three pillars of sustainability for stakeholders separately: crowd delivery companies, crowd couriers, customers, and society, to understand what had and had not previously been studied in the literature on crowd delivery utilizing inductive content analysis to derive the categories from the data (Elo and Kyngäs, 2008).

Research gaps on crowd delivery are subsequently identified while coding the results of a systematic literature review. The development of semi-structured interview questions to gather data from the field, gain additional insight, and Validatedate the literature review is then developed conbining research gaps that address the goals of the study and findings from the systematic literature review on sustainability benefits and risks.

According to the framework of the Stakeholder Theory, purposeful and snowball sampling is used to determine semi-structured interview participants from the supplier side and company side. Elo and Kyngas' 2008 study guidelines are used to conduct inductive content analysis on the data from semi-structured interviews (Elo and Kyngäs, 2008).

In order to triangulate the data on the sustainability benefits and risks of crowd delivery businesses, semi-structured interviews with suppliers, semi-structured interviews with firm representatives, and systematic literature review findings are combined to analyze.

Triangulation resulted in the identification of commonalities, differences, and novel results in the literature, with the goal of improving understanding of how crowd delivery firms currently work and can be improved regarding three pillars of sustainability.

Methodological flow processes of the thesis is presented in a diagrams in Figure 4.

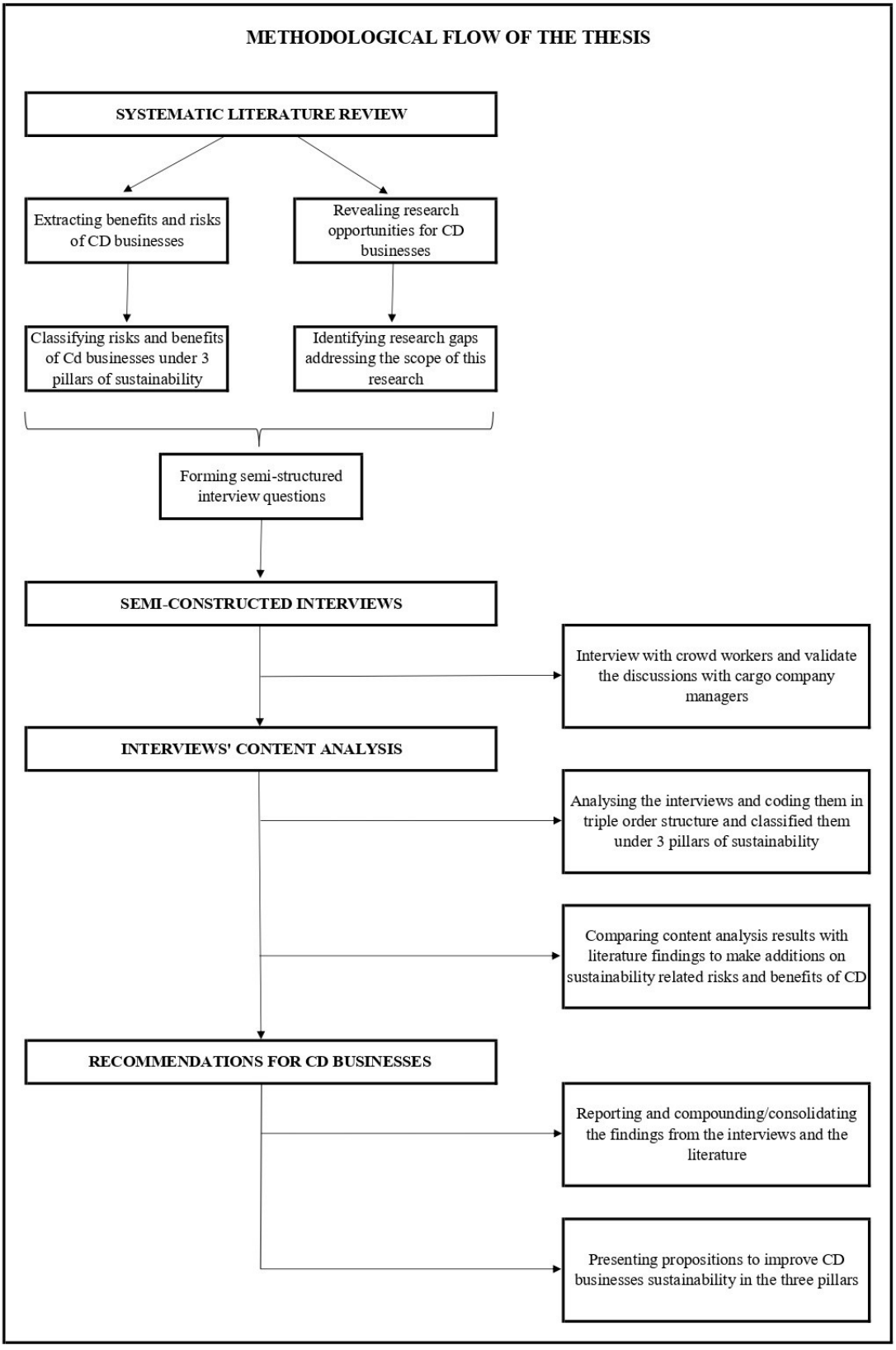


Figure 4. Methodological Flow of the Thesis

3.2. Methods Used in the Thesis

This thesis uses a multi-method approach by including SLR method and semi-structured interview method. Approach methods and how they are applied in this thesis are presented in this section.

3.2.1. Systematic Literature Review

A review of the literature, which can be conducted as standalone research or as part of a conceptual or empirical study. In either case, it tries to consolidate current information to assist and facilitate the production of new knowledge for a certain subject or field (Lim, Kumar and Ali, 2022).

Literature reviews assist researchers in better understanding previous work in their field, making it easier to identify gaps in the body of knowledge and potential fields for further research (Kraus et al., 2022).

The two basic types of review papers that are regularly seen in the scientific literature are "systematic" and "narrative" evaluations of the literature. These two types of review papers have distinct characteristics and purposes (Rother, 2007).

A qualitative technique is used in narrative literature reviews to describe and discuss a certain subject or theme from the literature. These review articles make no mention of the databases, methodological approaches, or inclusion criteria for qualified publications found through database searches. Rather, they provide readers with up-to-date information on a certain subject and are primarily arranged as introduction, development, discussion, and references on that subject (Rother, 2007).

A systematic review of the literature, on the other hand, is a well-planned review that uses a systematic and explicit approach to identify, select, and critically analyse the results of the studies included in the review. Articles that conduct systematic literature reviews are considered original works since they adhere to strict requirements (Rother, 2007).

This thesis uses the systematic literature review (SLR) method to provide a

comprehensive study of both the scope and the content of earlier studies on crowd delivery by following the essential steps of performing a SLR described in Pati and Lorusso's 2018 study using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) criteria (Pati and Lorusso, 2018).

For the purpose of examination of accumulated knowledge and identification of potential areas for study, first, relevant literature is searched utilizing a primary search code, because the terminology around this new subject is realized to be so diverse. It was a critical place to start in order to avoid overlooking any past research on the subject due to search code limits. Following this initial evaluation, the final search code is determined. Search code results yield to 113 qualified articles published between 2016 and 2022.

Elo and Kyngas' 2008 study on qualitative content analysis is followed while applying the inductive content analysis approach and adhering to PRISMA principles (Elo and Kyngäs, 2008).

SLR findings crowd delivery benefits and risks classification results yield to 52 sustainability benefits and 46 sustainability risks for the stakeholders with a distribution among sustainability pillars and related stakeholders.

Findings of systematic literature review are used to identify the research gaps in crowd delivery topic and reveal 12 research opportunities.

Systematic literature review findings are further used to form semi-structured interview questions on the sustainability benefits and risks of crowd delivery businesses to collect data from the field.

3.2.2. Search Code of the Systematic Literature Review

As SLR necessitates the identification of critical keywords as well as other variables that will aid in the search for literature sources, the Boolean logic was used to help locate and later refine the literature base for this aim. (Rześny-Cieplińska and Szmelter-Jarosz, 2019).

Web of Science (WoS) was chosen as the database since it is one of the most well-known and comprehensive databases. (Pranckutė, 2021).

PRIMARY SLR SEARCH CODE
Database: Web of Science
Title: crowd*
Results: 29.408 Years: 1975 - 2023
↓
Article: 16.780 OR Review Article: 522
Results after duplications removal: 17.302
↓
Language: English
Results: 16.918
↓
Web of Science Categories
Business: 859 OR Management: 894 OR Transportation: 225
Results after duplications removal: 1.672
↓
Following a quick review of the titles, refined terms that are relevant for search code as:
Title: crowd* deliver* OR crowd* ship* *(to include crowd-shipping, crowd-sourced shipping, crowd-shippers, shipping ... crowdsourcing)* OR crowdship* OR crowd* logistic* OR crowd* last* mile* OR crowd* freight*

↓

FINAL SLR SEARCH CODE	
Database: Web of Science	
Title: crowd* deliver*	Results: 143
Title: crowd* ship*	Results: 33
Title: crowdship*	Results: 21
Title: crowd* logistic*	Results: 58
Title: crowd* last* mile*	Results: 29
Title: crowd* freight*	Results:5
Total Results: 289	
Results after duplications removal: 232	
Inclusion Criteria 1: Document Type Article OR Revew Article	Results: 173
Inclusion Criteria 2: Language English	Results: 170
Exclusion Criteria 1: Removal of off-topic studies	Results: -48
Exclusion Criteria 2: Removal of closed access publications	Results: -9
Final Refined Results for SLR: 113	

Figure 5. Primary and Final SLR Search Code

Primarily, it should be emphasized that the final search code is determined following a necessary and extensive process on the WoS database utilizing a primary search code. Because the terminology around this new subject is so diverse. It was a critical place to start to avoid overlooking any past research on the subject due to search code limits. Following this initial evaluation, the final search code was chosen (Figure 5).

To begin, a basic evaluation of the database's title's field using the word "crowd*" is searched to gain an understanding of the variety of words used for such a new phenomenon. The total number of outcomes is 29.408. When the search was narrowed down to articles and review articles as document types, 17.302 studies were found. The choice of English as the study language, which is the most used in academia, resulted in a final score of 16.918. The database categories are then restricted to business, management, and transportation to discover relevant literature, yielding 1.672 publications (Figure 5).

Second, before constructing the final search code, a quick examination of 1.672 titles is performed to establish the terms required to understand the CD business model and extract all relevant research.

Based on the evaluation results, the final search code was developed, which comprised the highly diverse phrases of; crowd* deliver*, crowd* ship* (to include crowd-shipping, crowd-sourced shipping, crowd-shippers, shipping … crowdsourcing)., crowdship*, crowd* logistic*, crowd* last* mile* and crowd* freight* (Figure 5). The database is subsequently submitted to the final search code of the SLR. Determined wording yielded 232 outcomes, including 173 articles and review articles, 170 of which were published in English. After being reviewed, 48 of these articles' abstracts are found to be off-topic research and so not included in the final results. Following that, the remaining nine closed access publications are excluded. Finally, 113 publications published between 2016 and 2022 were qualified to examine and create a full systematic literature review (Figure 5).

Lastly, after determining qualified articles, last step in SLR analysis was to identify the variables, stakeholders and sustainability criteria examination approaches that would be used to determine the study's basic assumptions. This enabled the creation of the list of company and main stakeholders (CD service provider company, crowd courier, business and/or individual customer and society), 3 sustainability criteria (economic, social and environmental) and 29 variables (economic, social and environmental benefits and risks for CD company, crowd courier, business and/or individual customer and society separately, articles methodology, data source,

research design, focused supply chain partner, investigated sustainability issue of the study, research location, focused CD service provider company, crowd courier employment type, crowd courier job application requirements, CD business model terminology and crowd courier job title terminology) to investigate the literature.

3.2.3. Systematic Literature Review Data Extraction

Search code in Figure 5 is applied on Web of Science (WoS) database and qualified 113 articles are examined under 29 categories presented in the following.

In the first run, descriptive information from the articles is extracted and classified under; authors' names, article title, document type, source title, publisher, WoS database category, WoS database research area, topic of the article and year of publication. Then, articles are read in detail and their contribution to the literature and findings are put forth. Following that, content of the articles is examined and extracted knowledge is classified under economic, social and environmental benefits and risks of CD for company, consumer and crowd sides separately following the PRISMA method. (Pati and Lorusso, 2018). Lastly, articles are analysed for their methodology, data source, research design, concerned supply chain partner, sustainability issue of the study, research location, subject CD service provider company, crowd courier (CC) employment type, requirements to become a CC, CD business model terminology and CC job title terminology.

3.3. Semi-Structured Interview and Sampling

Semi-structured interviews are seen to be appropriate for data collection as it is the collection of narrative data from individuals or groups that results in an in-depth understanding of the phenomena of interest. Topics often consist of research questions aimed at better understanding if a proposed service is appropriate, how a service should be delivered, and/or how a service is currently performing or can be improved from the perspective of the provider and/or the recipient of a service (Adeoye-Olatunde and Olenik, 2021).

Sampling is a crucial part of qualitative research design since it affects the credibility of study findings. In other words, the credibility of study conclusions is strongly

dependent on sample participants' expertise of the issue. For these reasons, it is critical to carefully assess the most suitable sampling strategy for the intended aim of your study (Adeoye-Olatunde and Olenik, 2021).

Sampling is a critical component of qualitative research design since it determines the credibility of study findings. In other words, the credibility of study findings is strongly dependent on the expertise of sample participants about the subject. For these reasons, it is critical to carefully assess the optimum sampling strategy for your study's intended aim (Adeoye-Olatunde and Olenik, 2021). Purposive sampling strategy was chosen as the most common sort of non-probability sampling. Purposive sampling is a method of selecting participants based on specific interest characteristics (Adeoye-Olatunde and Olenik, 2021). In qualitative research, another sampling approach known as snowball sampling is widely used. It employs initial participant networks; when a researcher is attempting to learn more about a group or organization, it is beneficial to contact a few people who can guide the researcher in the direction of other groups. The study sample chosen will be useful for interacting, choosing, or sharing details to individuals (Etikan, 2017).
Purposive and snowball sampling is determined to meet the types of short haul urban crowd delivery businesses Table 1 classified by Alnaggar et al.'s 2021 study, based on their features (Alnaggar, Gzara and Bookbinder, 2021). Actors identified in Table 1 are chosen to examine what they are intended to accomplish with our semi-structured interview data.

SLR findings are used to form 48 semi-structured questions questionnaire on the sustainability benefits and risks of CD businesses to collect data from the field. Thirteen interviews, ten from supplier side and three from firm side, are thoroughly questionned on the sustainability benefits and risks of CD businesses. Three out of thirteen participants are reached via snowball sampling. Two initial participants from couriers' side directed the researcher to 3 participants working in other companies as crowd workers.

In qualitative research, the concept of data saturation, often known as information redundancy or the stage at which no new themes or codes emerge, is commonly used.

(Braun and Clarke, 2021) The interview process of this thesis was supported by content analysis, which also generated novel topics and made it possible to identify data saturation. After 10 interviews, there had been data saturation, meaning that no new codes had been discovered through the research. Data saturation was confirmed in three more interviews that were conducted. Sampling for semi-structured interviews is presented in short form in Table 1.

Reseach field of this thesis is decided as Turkey by leaning on the literature's gap revealed in SLR results, as a developing country and the researcher's geographical advantage. Interviews are conducted over the phone, in person, via WhatsApp audio or Zoom meeting. All audio are recorded and securely stored in a place that can only be accessed by the interviewer who is the researcher of this thesis. The total of the interviews are 8 hours 6 minutes and 8 seconds and the average duration is 37 minutes and 24 seconds per participant. All interviews are transcribed verbatim and formed 370 pages of content. Interview participants' average experience in the industry is two and a half years. Crowd couriers are chosen from individuals working with a wide range of companies including; courier companies with hybrid fleets composed of payroll couriers and crowd couriers, crowd courier supplier companies that supply couriers to grocery markets, crowd delivery companies that supply crowd couriers to online retailers, e-retailers' crowd delivery companies and express crowd delivery companies. Cargo branch managers are chosen from courier companies with hybrid fleets. Distance of all the crowd deliveries are within the range of urban short haul. Crowd couriers' delivery items and markets they serve for are grouped as any B2C online retailer items, any B2C e-retailer items, any B2B, B2C, C2C items, B2C grocery items and B2C restaurant, grocery and local shop items. Cargo branch managers' delivery items and markets they serve for are any B2B, B2C, C2C items. In the market crowd couriers are called by many names just like in the literature. Participants informed of their job positions in the companies as customer operations officier, parcel courier, small business owner courier, entrepreneur courier, business partner, driver courier, field staff, logistics delivery consultant and courier. Cargo branch managers are called cargo branch or agency manager by their companies. Eductional status of the crowd couriers range from high school to college and university graduate. Cargo branch managers' educational status are as the same variety.

Table 1. Sample Table of Semi-Structured Interviews

SAMPLE TABLE									
Participant	**Medium**	**Duration**	**Experience**	**Company**	**Distance**	**Item**	**Market**	**Position**	**Education**
CC1	Phone	00:47:36	Approx. 6 months	CDC	USH	Any online retailer item	B2C	Customer operations officer	C
CC2	Phone	00:52:57	Approx. 4 months	CCHF	USH	Any	B2B B2C C2C	Parcel courier	U
CC3	Phone	00:38:02	Approx. 7 months	CCHF	USH	Any	B2B B2C C2C	Small business owner courier	HS
CC4	Phone	00:36:07	3 years	E-CDC	USH	Any	B2C	Entrepreneur courier	U
CC5	Zoom Meeting	00:58:57	2 years	E-CDC	USH	Any	B2C	Business partner	U
CC6	Phone	00:50:20	Approx. 2,5 years	E-CDC	USH	Any	B2C	Driver courier	HS
CC7	Phone	00:22:25	Approx. 4 years	ECDC	USH	Restaurant, Grocery, Local Shops	B2C	Field staff	HS
CC8	Whatsapp Audio	00:39:17	2 years	CCSC	USH	Grocery	B2C	Logistics delivery consultant	HS
CC9	Phone	00:27:00	Approx. 6 years	CDC	USH	Any online retailer item	B2C	Small business owner courier	HS
CC10	Phone	00:22:01	3,5 years	CCSC	USH	Grocery	B2C	Courier	HS
BM1	In Person	00:20:21	2,5 years	CCHF	USH	Any	B2B B2C C2C	Cargo branch manager	U
BM2	Phone	00:28:42	2 years	CCHF	USH	Any	B2B B2C C2C	Agency manager	C
BM3	Phone	00:42:23	5 years	CCHF	USH	Any	B2B B2C C2C	Agency manager	HS
Total		08:06:08							
Average		00:37:24							

Abbreviations: CC is for Crowd Courier, BM is for Courier Company Branch Manager, CDC is for Crowd Delivery Company, CCHF is for Courier Company with Hybrid Fleet, E-CDC is for E-retailer Crowd Delivery Company, ECDC is for Express Crowd Delivery Company, CCSC is for Crowd Courier Supplier Company, USH is for Urban Short Haul, HS is for High School, C is for College, U is for University.

3.4. Content Analysis

Content analysis is used to systematically and objectively describe and quantify qualitative data. Since distilling words into fewer content-related categories and classifying words and phrases with similar meanings into the same categories, the content analysis method enables the researcher to make more sense of the data (Elo and Kyngäs, 2008). Specifically, inductive analysis is applied to organize semi-structured interviews data according to Elo and Kyngäs's 2008 study guidelines.

Preparation stage of content analysis necessitates selection of unit of analysis. Deciding on what to analyze and sampling are considerations of this stage (Elo and Kyngäs, 2008). The organization of the qualitative data is the next step and this procedure entails open coding, categorizing and abstraction stages (Elo and Kyngäs, 2008).

Open coding requires taking notes while reading the unit analysis and then freely creating categories. Following that, these categories are transferred onto the coding sheet. The lists of categories are then organized under higher level categories. The creation of categories serves to increase understanding, produce knowledge, and provide a means of defining the phenomenon (Elo and Kyngäs, 2008).

The abstraction stage entails creating categories and giving each category a name using terms that describe the content of the category. Content that fall into the same subcategory are combined to form categories, and categories are combined to form main categories (Elo and Kyngäs, 2008).

Then content analysis necessitates to carry out reporting of the study and presenting its results. Final stage is distilling the findings and creating a model out of the findings. Inductive content analysis method is considered suitable for both SLR and semi-structured interview content analysis. Elo and Kyngäs, 2008 content analysis steps are followed as reported in the following.

In the preparation stage, unit of analysis is decided using a detailed seach code deriving studies in the literature on Crowd Delivery and semi-structured interview

questionnaire is developed leaning on SLR findings. Interviews are conducted and transcribed verbatim and formed 370 pages of content to be analyzed. All articles resulting from the search code and interview transcripts are read in detail to make sense of the data as a whole.

First, open coding is actualized by taking down notes while reading the articles from the literature and interview transcripts. Then, notes from the readings are used to create categories to transfer onto the coding sheet. Following that, grouping is done for related content to form higher order categories. After that, abstraction is done by forming subcategories and main categories using terms that describe the content of the categories.

In the reporting of the analyzing process and the results stage, the study is reported, and results are presented. Finally in the last stage a model is formed based on the study results.

3.5. Quality of Research

To assist the examination and evaluation of the aspects of this study, Fossey et al.'s 2002 criteria for evaluating the quality of a qualitative research is utilized (Fossey et al., 2002). The results prove to satisfy all related criteria. Presented in Table 2.

Table 2. Quality of the Research Assessment of the Thesis (Source: Fossey et al., 2002)

Methodological Rigour	
Congruence/ Conformity	Methods utilized are appropriate for the technique chosen since a qualitative approach is required for an analysis of several actors and their different perspectives. The study is carried out in a manner consistent with the methodology. SLR and semi-structured interviews are used to collect data from literature and field in order to acquire more insight and validate the findings of the literature review.
Responsiveness to Social Context	Research design is developed and adapted to respond to situations that occurred in social contexts. Semi-structured interviews allowed the researcher to interact with participants and familiarize oneself with the study's setting. By applying the interview questionnaire to 13 participants with an average of 37 minutes 24 seconds per participant, the researcher interacted with the individuals and became familiar with the study matter.
Appropriateness	Purposeful sampling technique is appropriate for identifying participants and support the research issue. Sampling strategy is suitable to identify the participants. Ten crowd couriers from supplier side and three cargo branch managers from compny side are included.

	SLR is conducted by a search code that precisely and comprehensively provides suitable material for the study. Data gathering methods are suitable to inform the research questions.
Adequacy	Detailed description of search code and sample group is provided. All interviewees fully participated to the interviews. Detailed description of data gathering and analytical processes are followed. Multiple sources of information are used, all stages of inductive content analysis is applied. Interviews are conducted in the participants' native tongues so they could more easily express themselves and their thoughts. The researcher paid attention to ensure that the approaches were thoroughly explained.
Transparency	All 113 articles analyzed for SLR are available on Web of Science database. All semi-structured interviews are voice recorded, transcriptions are presented verbatim, and coding processes are included step by step. Data accounts from opposing sources are given and included (company side and supplier side). Data collection approach gives participants' knowledge priority,but participants' knowledge is not given priority over one another on their level of experience.
Interpretive Rigour	
Authenticity	Verbatim quotes are used to present the participants' opinions in their own words. Dissident opinions are expressed both within and between the supplier and firm sides. Descriptions and interpretations have been meticulously written to be recognizable to those who have really experienced the events they refer to. The participants are not involved in documenting, checking or analyzing data or reviewing the analysis.
Coherence	To establish plausibility, consideration is given to the connections between the data and the findings. By receiving confirmation from two distinct Associate Professors who are currently employed—one of whom is the thesis' advisor and the other is from a different institution—the perspectives of several researchers are taken into consideration regarding validatedation of content analysis.
Reciprocity	Process of conducting the analysis is not shared with semi-structured interview participants and they are not involved in presenting of the study, as they have given signed consent for the information they provided to be used as scientific data.
Typicality	As generalizability of findings to a particular larger population is not guaranteed by qualitative research, and interpretations provided includes enough information for others to assess the applicability of the research findings to their own circumstances. While it is the duty of qualitative researchers to provide a complete analysis, the reader needs to determine whether the description is appropriate in another context.
Permeability of the Researcher's Intentions, Engagement, Interpretations	By providing and supporting the interpretations as well as by outlining each stage from SLR and semi-structured interview raw data to written report, the researcher's role in the interpretative process is evident. Crowd delivery is a new topic, therefore the study expanded the researcher's original understanding of the phenomena, gave the researcher in-depth knowledge of the standards, methods, and execution. The researcher's objectives, preconceptions, values, and personal experiences throughout the study process are not made clear in the report because they were handled objectively and transparently.

CHAPTER 4: SYSTEMATIC LITERATURE REVIEW RESULTS

4.1. Descriptive Results of Systematic Literature Review

*Publishing journals; w*ith 9 and 8, respectively, "Sustainability and Transportation Research Part E-Logistics" and "Transportation Review" have the greatest publication rates. 42 distinct journals constitute the remaining 68 source titles. As a result, it appears to be a topic of interest to a wide variety of journals.

*Publishers; w*ith 19 and 11 publications, respectively, "Pergamon-Elsevier Science Ltd" and "MDPI" stand out among the many publishers embracing crowd delivery. The remaining material is published by 17 different publishers. 11 articles from "Economics; Engineering, Civil; Operations Research and Management Science; Transportation; Transportation Science and Technology" were found in the database categories research, while the remaining 78 articles are divided into 34 other categories with similar weights. The topic has been covered in both an interdisciplinary and extremely fragmentary manner, as illustrated by the numerous distinct publications that have published on the topic.

Research Areas; the research fields represented by "Business and Economics" and "Business and Economics; Engineering; Operations Research and Management Science; Transportation" are 11 and 10, respectively. The remaining 22 research areas are split among others, but mostly computer science. Crowd delivery's promise of economic advantage and need for internet infrastructure are valid reasons to explain this distribution.

*Year of publications; w*ith four published research, the year of publication begins in 2016. In 2017, 10 were followed by 8 in 2018, a sharp rise to 22 in the year 2019, then a minor descent to 18 in the following year. 25 in 2021, 21 in 2022, 5 early access, and 1 undefined are published the period that comes after. Presented in Figure 6. It is seen that the interest in crowd delivery is in an upward trend in general. Although it is a subject that needs more attention due to the pandemic period between 2019 and 2022, quantity of publications fluctuate. Perhaps this period can be explained by the general slowdown of the pandemic on work life.

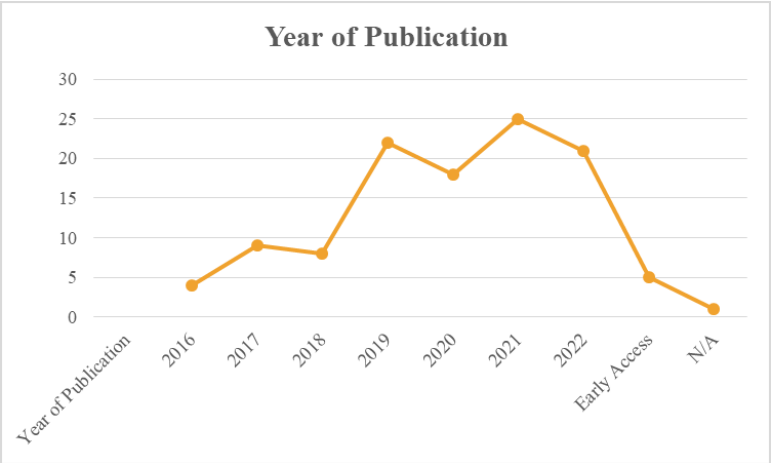


Figure 6. SLR Results of Crowd Delivery Topic Publications per Year

Methodologies of research; distribution is as 98 out of 113 are quantitative studies. Qualitative approach is adopted in 9 and mixed method, including both quantitative and qualitative elements, in 6. Presented in Figure 7.

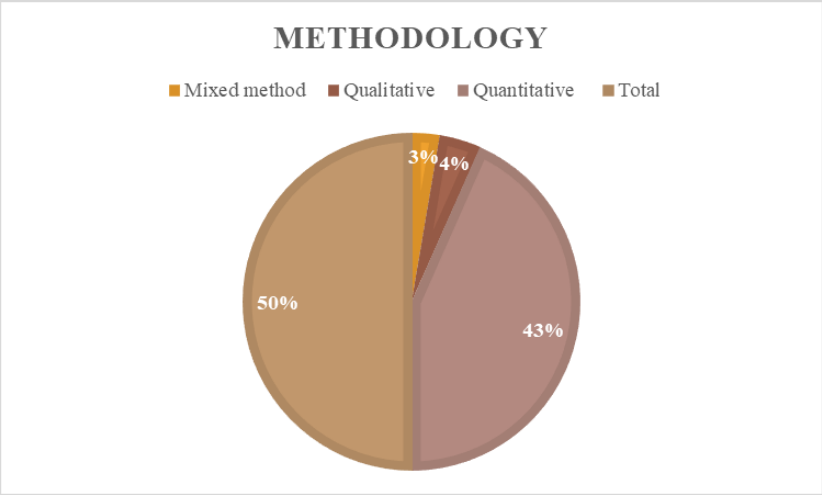


Figure 7. SLR Results of Crowd Delivery Topic Research Methodologies

Data sources of research; of articles are mostly mathematical computation on secondary data (real world data), mathematical computation on an algorithm and survey. Following data sources are spread among many methods (Table 3).

Table 3. SLR Results of Crowd Delivery Topic Research Data Sources

Data Source	Quantity
Mathematical computation on secondary data (real world data)	46
Mathematical computation on an algorithm	24
Survey	15
Literature review and secondary data	4
Interview and survey	3
Literature review	2
Secondary data and survey	2
Systematic literature review	2
Systematic literature review and semi-structured interview	2
Case Study	1
Interview	1
Mathematical computation on case study and survey	1
Online survey (stated choice experiment)	1
Secondary and declarative data	1
Secondary data and interview	1
Secondary data and semi-structured interview	1
Secondary data from social media	1
Secondary data, case study and interview	1
Secondary data, case study and survey	1
Semi-structured interview	1
Survey and scenario	1
Systematic literature review and survey	1

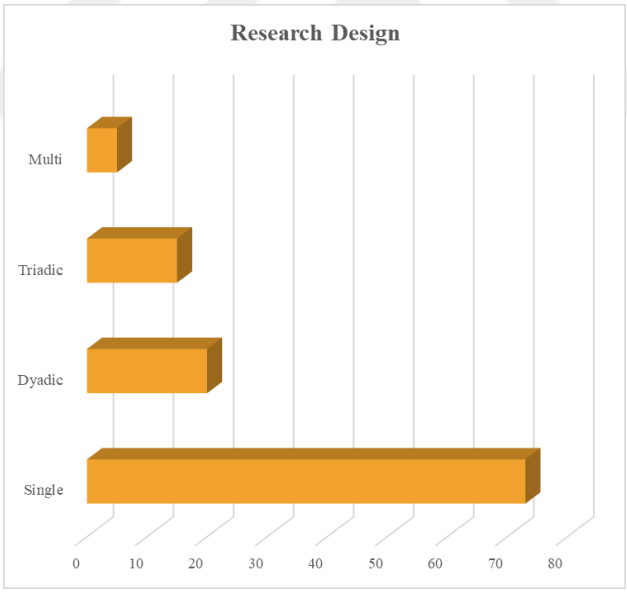


Figure 8. SLR Results of Crowd Delivery Topic Research Designs

*Research design of research; s*ingle sided studies that investigate only one of the supply chains (SC) partners amount to73 of results. Dyadic sided studies that view two SC partner of CD are 20. Triadic studies with three SC partner views are 15. Multi sided studies that view more than three SC partners are 5 in total. Details of the supply chain partner distribution is presented in Figure 8 and Table 4.

Table 4. SLR Results of Crowd Delivery Topic Research Design in the Literature

Supply Chain Side	Quantity of Research	Research Design
CD provider company or retailer	1	Single
Retailer/production company	2	Single
Environment	2	Single
Courier/logistics company	3	Single
Consumer (sender or receiver)	9	Single
Company	6	Single
Crowd	23	Single
CD provider company / Platform	27	Single
Consumer (sender) and Consumer (receiver)	1	Dyadic
CD provider company and Crowd	6	Dyadic
Company and Crowd	5	Dyadic
Consumer (sender) and Crowd	4	Dyadic
Environment and Crowd	1	Dyadic
Consumer and Crowd	3	Dyadic
CD provider company, consumer (sender) and Crowd	5	Triadic
CD provider company, consumer and Crowd	3	Triadic
CD provider company, courier company and Crowd	1	Triadic
Company, crowd and consumer	1	Triadic
Consumer (sender), consumer (receiver) and CC	4	Triadic
Retailer, consumer and Crowd	1	Triadic
CD provider company, courier company, consumer (sender),consumer (reciever) and Crowd	1	Multi
CD provider compnay, e-retailer, consumer (sender), consumer (receiver) and Crowd	1	Multi
Courier company, public transport company, entrepreneur, local authority, individual (public)	1	Multi
Institutional authorities/decision makers, company, CC, consumer	1	Multi
Senders, receivers, couriers, and platforms	1	Multi
Total	**113**	

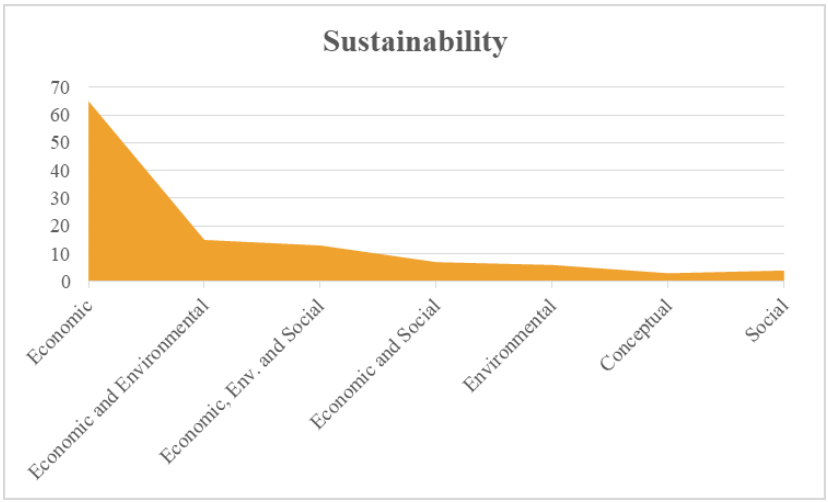


Figure 9. SLR Results of Crowd Delivery Topic Research Sustainability Pillar Focus

Sustainability pillar focus; of researches that study economic sustainability amounts to 65, economic and environmental 15, economic and social 7, economic environmental and social 13, environmental 6, social 4, conceptual 3 articles. Presented in Figure 9.

Methodologies, data sources, research design and sustainability pillar focus of studies being mostly quantitative, mathematical computation, company only and economic respectively can be explained by the fact that crowd delivery's biggest promise is proposing an asset-light and higher revenue last mile delivery business for service providers.

Research field location; of country distribution results are as follows. USA 30, merely mathematical/computational studies 24, China 22, followed by a drastic decrease to Italy by 6, international/global 3, Belgium 3, Germany 3, and Netherlands 2. The rest is distributed among the following by 1 each, Denmark, Israel, USA and Literature, South Korea, Finland, France, India, Literature and reports, Poland, Saudi Arabia and literature, China and Singapore, Slovakia, Spain (Figure 10). The distribution of research locations can be conveniently explained by the intensity of implementation of crowd delivery.

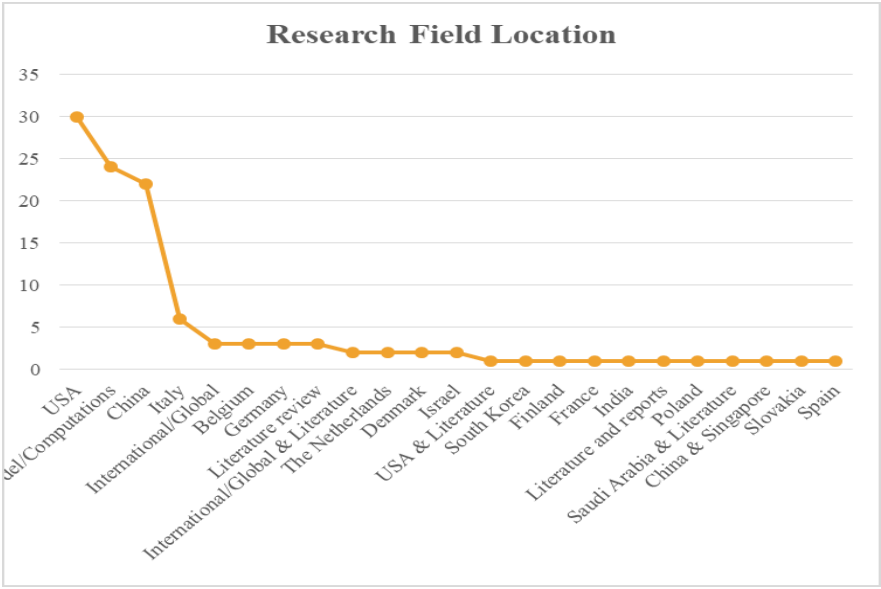


Figure 10. SLR Results of Crowd Delivery Topic Research Field Locations

Crowd Delivery service provider companies; investigated in the literature are densely from developed economies of USA and Europe. Amazon companies with 52, next comes Uber companies with 36, DHL companies 32. Details are listed in Table 5. In the literature, it is reasonable to mention the names of leading and popular companies more often.

Crowd courier employment types; are not specified in 10 of the total sums, the rest is as follows. 79 implies employment category as ad-hoc (occasional, temporary), 10 as taxi driver side job, 7 as part-time, 2 as freelance, 2 as independent contractor, 1 autonomous vehicle (driverless), 1 contract based and 1 as full-time and part-time. Listed in Table 6. The examination of job titles shows that crowd delivery is typically an occupational or part-time employment.

Table 5. SLR Results of Crowd Delivery Service Provider Companies in the Literature

Crowd delivery service company	Quantity
Amazon companies	52
Uber companies	36
DHL companies	32
Deliv	28
Postmates	24
Walmart companies	23
Instacart	13
Roadie	13
Doordash	10
Grubhub	9
PiggyBee	8
Trunkrs	8
Nimber	7
Dada	6
Deliveroo	6
PiggyBag	6
Google	5
Hitch	4
Renren Kuaidi	4
Seamless	4
Zipments	3
Remaining 84 are mentioned in 1 or 2 articles each	1 - 2

Requirements to become a crowd courier; are not specified in 44 articles. Described only as having a type of vehicle or being a pedestrian or passenger (mostly with a pre-planned trip) in 33 of the studies. Rest is distributed among being an acquaintance of the receiving customer, simply registering to crowd delivery online platform as courier, having a smart phone, being an in-store customer of a retailer, and mostly

similar singular conditions. Presented in Table 7. It can be deduced that this subject is not emphasized much in the literature, since there are generally not many prerequisites or barriers to become a crowd courier.

Table 6. SLR Results of Crowd Courier Employment Types in the Literature

Crowd Courier Employment Type	Quantity
Ad-hoc (occasional, temporary)	79
N/A	10
Taxi driver side job	10
Part-time	7
Freelance	2
Independent contractor	2
Autonomous vehicle (driverless)	1
Contract based or matching individuals	1
Full-time and part-time	1
Total	**113**

Table 7. SLR Results of Requirements to Work as a Crowd Courier

Requirements to Become a Crowd Courier	Quantity of Studies that Mentioned Requirements
N/A	58
having a vehicle	10
having a pre-planned trip	5
registering to crowd delivery online platform as courier	4
being a taxi driver with a passenger occupied taxi	3
having idle time and capacity (resource) to transport goods	3
being a passenger having a pre-planned trip	2
being a taxi driver and having a taxi	2
having a personally owned vehicle	2
two-hour training, deposit, older car models allowed OR sign contract, no training required, no deposit, but agree to pay up to a certain amoount in cases of non-delivery, damage, or loss OR contract-based or no contract (matching individuals)	1
access to a car and driver's license	1
being a food delivery worker	1
being a neighbour of the consumer	1
being a pedestrian or a cyclist	1
being a taxi driver	1
being a taxi driver or walker or runner or bicyclist	1
being a university student, retiree or freelancer	1
being a user of the free-floating bike-sharing system	1
being a volunteer	1
being an acquaintance of the consumer	1
being an acquaintance or neighbour of the consumer	1
being an employee of a large distribution center or sales outlet	1
being an in-store customer of a retailer	1
having a bicycle	1
having a pre-planned metro trip	1
having a smartphone	1
having a vehicle or being a pedestrian	1

having a vehicle, being a pedestrian or using public transport	1
having drivers' licenses, insurance, and proof of dependable vehicle, access to a vehicle or being a pedestrian or using public transport, having idle space for storage	1
having idle capacities to transport goods	1
passing security checks and completing basic workshops	1
registering to crowd delivery online platform as courier and driving license	1
using public transport as passenger with a non-dedicated trip	1
Total	**113**

Remarks for terminological diversity in the literature; Crowd Delivery terminology is strikingly diverse. There are 27 different names for CD in the literature; "crowdsourced delivery" and "crowd logistics" seem to be most popular, each are over 20 times mentioned. Details are presented in Table 8 and Figure 11. Crowd courier (CC) job titles are also diverse. There are 39 different names for workers in the literature; "crowd" and "crowdshipper" seem to be most popular, each 14 times mentioned. Details are in Table 9 and Figure 12. Since crowd delivery is a new topic, it can be thought that this variety of terminology will be simplified over time.

Figure 11. Terminology Diversity of Crowd Delivery in the Literature

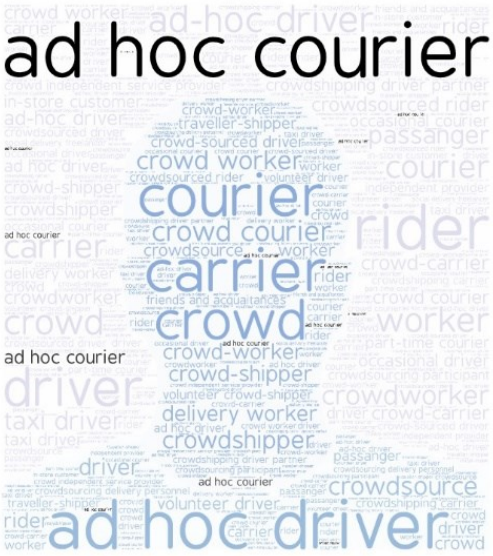


Figure 12. Terminology Diversity of Crowd Courier Work Title in the Literature

Table 8. Crowd Delivery Terminology in the Literature– Alphabetically

Crowd Delivery Business Model Terminology - Alphabetically	
crowd delivery	2
crowd logistics	21
crowd logistics delivery	1
crowd shipping	1
crowddeliver	1
crowd-delivery	1
crowdshipping	18
crowd-shipping	17
crowdsourced delivery	23
crowd-sourced delivery	1
crowdsourced last mile	1
crowdsourced logistics	4
crowdsourced package delivery	2
crowdsourced parcel delivery	1
crowdsourced parcel service	1
crowdsourced shipping	1
crowdsourced urban delivery	1
crowdsource-enabled system for urban parcel relay and delivery	1
crowdsourcing	1
crowdsourcing approach for last mile delivery	1
crowdsourcing delivery	1
crowdsourcing distribution	1
crowdsourcing logistics	7
crowdsourcing package delivery	1
real-time logistics	1
spatial crowdsourcing	1
spatiotemporal crowdsourcing	1
Total	**113**

Table 9. Crowd Courier Work titles in the Literature

Worker Title - Alphabetically	Quantity	Worker Title - Alphabetically Cont.	Quantity Cont.
ad-hoc driver	3	crowdsourcing participant	1
carrier	4	crowdsourcing rider	1
courier	4	delivery worker	1
crowd	14	driver	7
crowd - crowdsourcee	1	employee	1
crowd carrier	2	independent provider	1
crowd courier	1	in-store customer	1
crowd independent service provider	1	N/A	8
crowd worker	6	non-expert courier	1
crowdshipper	14	occasional courier	5
crowdshipping carrier	1	occasional driver	9
crowdshipping driver partner	1	part-time courier	1
crowdsource	2	rider	1
crowdsourced courier	1	social delivery freelancer	1
crowdsourced driver	5	taxi driver	4
crowdsourced rider	1	traveller-shipper	1
crowdsourced worker	1	volunteer crowd-shipper	1
crowdsourcee	1	volunteer driver	1
crowdsourcer	1	worker	1
crowdsourcing delivery personnel	2	**Total**	**113**

4.2. Research Opportunities Results of Systematic Literature Review

With regards to answering RQ1 of this thesis and as a result of detailed reading and of all the search code resulted studies and descriptive analysis, 12 research gaps that form the research opportunities on Crowd Delivery in the literature are revealed as below.

RO1: Quantitative studies are disproportionately high. Since CD is an infant business model dating back only to 2012, more qualitative research needs to be done in order to deeper understand the components and operation mechanisms.

RO2: The researcher is aware of the value of on-site, field information for such a complex delivery chain with multi stakeholders. Following the results, it has become evident that such studies are needed.

RO3: Human factor is at the centre of CD as revealed in the benefits and risks section. Supply and demand sides preferences and acceptance rate decides the course of this business model. Survey method is not an insignificant amount but further use of interview data collection techniques might supply a deeper understanding of the dynamics.

RO4: Single supply chain partner focus is intense. The majority are CD provider companies, followed by CC. Other stakeholders are of equal importance as members of the chain, especially consumers' acceptance and willingness need to be studied to grasp the dynamics of their preferences.

RO5: Courier/logistics companies seem to be moving onto hybrid fleet model with crowd element, so hybrid models of CD form another research opportunity for the literature.

RO6: Dyadic studies are low in quantity. Studying two of SC partners together, covering their bilateral relations and interactivity of their relationship holds a great deal of importance for a sustainable business model. In detail, more research on CD service provider companies and CC as well as consumer and CC relations is needed, to remove the bottlenecks presented in the risks section above.

RO7: Triadic and multi SC partner studies are quite fairly distributed within themselves, yet they make up a small amount of the whole. It is important to approach the partners holistically, to fully understand the situation in a general framework.

RO8: Economic sustainability concerns hold majority of the literature. Social sustainability finds place in 24 articles and environmental sustainability in 34. Social resilience of CD deserves a better focus since social welfare, security, safety, reliability, acceptability and trust are at the center of resilience bottlenecks, as explained in the risks section above. Environmental sustainability is crucial for the wellbeing of society and calls for further study.

RO9: Economic and social sustainability risks on CC and consumer is under studied compared to company. These elements have a significant impact on the supply and demand sides of CD, so their resilience needs to be investigated in depth.

RO 10: Research locations and CD platforms are limited to advanced economies in a vicious cycle. Investigating CD initiatives and practices in emerging economies is crucial to filling this research gap. The researcher would like to emphasize the distinct

business cultures in different country settings call for research on more diverse social and economic backgrounds.

RO11: As mentioned companies are from developed economies, there is room for research in emerging economy companies globally.

RO12: Requirements to become a CC issue has not been given enough attention yet. Scarcely described and shortly mentioned in the articles. Given the global variety of platforms, this subject calls for further investigation. In-depth research might shed some light on social and economic bottlenecks concerning CCs.

4.3. Sustainability Benefits and Risks Results of Systematic Literature Review

As mentioned in Section 1.2., crowd delivery have risks as well as benefits. In relation, crowd delivery businesses' sustainability benefits and risks from the literature are presented in this section. SLR findings on sustainability benefits and risks are listed in short form in Table 10. Detailed table is included in Appendix D.

Table 10. SLR Findings on Crowd Delivery Sustainability Benefits and Risks Summary

SLR Findings - Sustainability Benefits and Risks	Criteria Quantity	SLR Findings - Sustainability Criteria Example
Company Economic Benefit	11	Higher delivery efficiency, Reduced costs
Crowd Economic Benefit	5	Creates income source, Labor and workload friendly
Customer Economic Benefit	11	Faster delivery, Flexibility
Company Social Benefit	6	Safety precautions
Crowd Social Benefit	7	Voluntary character , Empowering communities
Customer Social Benefit	7	Simplicity, Trust
Society Environmental Benefit	5	Minimizing negative impacts of deliveries
Total Sustainability Benefits	**52**	
Company Economic Risk	6	Balancing demand and supply sides, Encouraging initial and continued participation of crowd
Crowd Economic Risk	7	Cost concerns, Cultural and demographic barriers
Customer Economic Risk	3	Service quality ambiguity, Loss of control
Company Social Risk	9	Reputation concerns, Liability concerns
Crowd Social Risk	8	Health concerns, Privacy issues
Customer Social Risk	9	Liability concerns, Service reliability concerns
Society Environmental Risk	4	Rebound effects of modal choice
Total Sustainability Risks	**46**	

4.3.1. Economic Sustainability Benefits for Companies

The results of SLR economic sustainability benefits show that crowd delivery attracts logistics service providers (LSPs), crowd delivery service providers (CDSPs), crowd delivery platforms (CD platforms) and e-retailers; because of its asset light infrastructure, which eliminates the need for investment in employees, vehicle fleet, and vehicle maintenance. CD involves less capital expenditure than traditional delivery because it uses existing resources such as couriers' own vehicles (Buldeo Rai et al., 2017). Less capital is required, allowing for faster business expansion (Gläser, Jahnke and Strassheim, 2021).

As crowd couriers are part-time rather than full-time couriers CD allows diminished drivers' costs (Zhang et al., 2022). Crowd couriers fulfil delivery tasks in return for small compensations solely (Behrend et al., 2019). Thus, keeps the crowd external to the company unlike an employee and this releases companies from the financial and social burden of employer commitments and obligations (Buldeo Rai et al., 2017). Drivers are hired by task rather than by time, allowing businesses to eliminate fixed expenditures, empty moves, and idle-time expenses (Castillo et al., 2018).

Requires less investment to logistics infrastructure such as warehouses or vehicle fleets (Punel, Ermagun and Stathopoulos, 2018). Thus, leads to lower depreciation and operating costs (Gläser, Jahnke and Strassheim, 2021). Eliminates fleet maintenance and fuel costs leading to revenue creation. Provides efficiency, based on a minimalist structure and the power of crowd (Buldeo Rai, Verlinde and Macharis, 2018). Implements capability to provide cost-effective delivery services by making use of crowd's existing transportations (Feng et al., 2021). Grants low cost with little detours because commuters who are already on the road may offer a lower delivery price by distributing to locations close to their routes (Gläser, Jahnke and Strassheim, 2021). Providing services in a cost-effective way, for example, reduces penalty for servicing consumers outside of their preferred time frames (Kafle, Zou and Lin, 2017).

Because it provides all these cost savings by using crowd resources, it is safe to say that crowd delivery logistics providers are transferring all the business risk to crowd couriers (Carbone, Rouquet and Roussat, 2017).

Decrease delivery costs by utilizing unused vehicle capacity of crowd couriers to reduce the need for further trips to ship items (Miller, Marco Nie and Stathopoulos, 2017). Thereby also reduces the number of delivery trips and distances travelled (Shen and Lin, 2020).

Another reason CD is an attractive business model for companies is that it allows for faster delivery compared to traditional delivery (Alnaggar, Gzara and Bookbinder, 2021). Deliveries by crowdsources are independent of one another, allowing for speedier delivery. If one delivery is delayed, it has no negative impact on subsequent deliveries (Gläser, Jahnke and Strassheim, 2021). Travelers who are already familiar with the locations can also reduce delivery time (Gläser, Jahnke and Strassheim, 2021). Platforms informative technology assist drivers with routing by providing effective route solutions, which can lead to speedier deliveries (Li et al., 2019).

Due of crowdsources' flexibility, same-day delivery is possible (Savelsbergh and Ulmer, 2022). Customers are willing to pay up to 10% more for same-day deliveries, which is economically advantageous for companies (Cieplińska and Szmelter-Jarosz, 2020). CD methods of operation not only allows same-day but even 2-hour deliveries (Nieto-Isaza, Fontaine and Minner, 2022).

CD business model has the potential to enhance total delivery efficiency when compared to traditional truck delivery (Kafle, Zou and Lin, 2017). Increasing distribution efficiency results in significant economic benefits for companies (Bin et al., 2020).

Provides more efficient deliveries, a greater number of deliveries, simpler ways to finding the parcel destinations, less delays, and fewer repeated visits (Alharbi, Cantarelli and Brint, 2022).

Machine learning algorithms, GPS systems, decision support systems, databases, and other informational support systems on CD platforms help to match supply and demand and improve logistical performance (Zhang et al., 2019).

By making use of an online platform, companies leverage the crowd's traffic data or benefit from its knowledge of short and fast routes to improve route planning or use the data to forecast delivery punctuality (Gläser, Jahnke and Strassheim, 2021).

With the help of advanced technology, sharing location and real-time tracking improves efficiency and allows for easier access to locations (Alharbi, Cantarelli and Brint, 2022). Platforms give optimal route solutions to drivers, which can lead to more efficient deliveries (Li et al., 2019).

CD solves the last-mile delivery problem by optimizing real-time logistics distribution (Bin et al., 2020). Drop-off flexibility contributes to less unattended home deliveries. Improving parcel turnaround time and failure rate (Li, Wang and Rezaei, 2020). More deliveries are completed successfully, and fewer reverse logistics is required (Alharbi, Cantarelli and Brint, 2022). Using an online platform reduce failure rate by allowing direct communication between senders, crowd couriers and recipients (Gläser, Jahnke and Strassheim, 2021).

Furthermore, making the distribution more efficient by selecting the best suited driver to complete the delivery (Carbone, Rouquet and Roussat, 2017). Effective delivery task assignment results in efficient and flexible last-mile delivery (Wang et al., 2019). Thus, advances optimizing resource allocation and boosts the efficiency of distribution services (Wang and Xie, 2021a).

CD provides more flexibility than traditional delivery methods. (Zhen et al., 2021). The source of its improved flexibility is the flexibility of its assets, specifically vehicles and drivers (Punel and Stathopoulos, 2017).

CD solution can provide a variety of options and distributors, every time and every place, to all route (Cieplińska and Szmelter-Jarosz, 2020). Flexible delivery assets enable operations 24 hours a day, seven days a week. For instance, by utilizing taxi rides for delivery trips (Chen et al., 2017).

Flexible last mile delivery offers time-precise delivery (Wang et al., 2019). It should

be noted that this is made feasible by its more flexible on-demand workforce (Simoni et al., 2020). Meal delivery is an extreme illustration of how CD capacity flexibility may support consumers' variable delivery time choices (Savelsbergh and Ulmer, 2022).

An elevated level of operational flexibility allows for improved service levels (Savelsbergh and Ulmer, 2022). For example, the capacity to provide personalized delivery services by better utilizing existing transportation tools (Feng et al., 2021).
CD allows logistics operators to better serve their customers (Akeb, Moncef and Durand, 2018). This is made possible by higher quality of service (Zhang et al., 2017). They increase customer satisfaction in this way (Ermagun and Stathopoulos, 2021). As an instance with CD, they gain the potential to give greater consumer value through personalized service (Li et al., 2019).

Furthermore, because commuters who are already traveling may offer a lower rate, being familiar with the regions can shorten delivery time, and consequently changing consumer needs are better addressed (Gläser, Jahnke and Strassheim, 2021).
As a result of service improvements, better recurring customer purchase rates may be obtained (Ta, Esper and Hofer, 2018).

Although it is rarely highlighted in the literature, another economic benefit of CS to businesses is transparency.Tracking of the shipment is feasible using internet platforms, resulting in good service quality (Gläser, Jahnke and Strassheim, 2021). Online CD platforms, which are more sophisticated than traditional logistics carriers, enable real-time communication, tracking, and tracing services (Le et al., 2019). This, in turn, provides for greater efficiency and service quality. It even allows access to remote and rural locations (Alharbi, Cantarelli and Brint, 2022).

CD provides more capacity and accessibility by always offering a variety of options and providers and to any location or route required (Szmelter-Jarosz and Rześny-Cieplińska, 2020).

Using the CD model gives service providers access to many workers who are

potentially available to deliver services (Basik et al., 2021). Which, in turn, reduces human resource shortages (Bin et al., 2021). The likelihood of having one available carrier within a brief period is remarkably high', resulting in shorter delivery times and lower delivery costs (Gläser, Jahnke and Strassheim, 2021). As a result of which better capacities are attained (Behrend et al., 2021).

CD initiatives of e-retailers (for example, Amazon Flex or Walmart) achieve increased delivery capacity for home deliveries in a cost-effective manner (Boysen, Emde and Schwerdfeger, 2022).

The benefits of improving resource allocation include the ability for service providers to engage many individuals as part-time workers (Wang et al., 2016). CD enables utilizing crowd resources, maximizing crowd utility, optimizing loading capacity, and increased capacity (Rechavi and Toch, 2020). This allows service providers to better meet increasing demand by making better use of excess capacity (Simoni et al., 2020). Although not mentioned often in the literature, CD can deliver more reliable services owing to informative support systems.

Machine learning algorithms, GPS systems, decision support systems, databases, and other information support systems are used by online CD platforms to help supply-demand matching and improve logistics performance. Furthermore, informative support provides feedback systems, a secure online payment system, and insurance, which aids in risk management and the security of transaction and operational activities (Zhang, 2019).

As a result, they serve critical roles in enhancing the reliability of logistics services, hence contributing to logistics performance. With its flexible workforce, increased capacity, and accessibility, CD can reach a broader service area and enter new markets.

CD can distribute to a vast geographical scale, ranging from intra-urban to inter-urban to global (Rześny-Cieplińska and Szmelter-Jarosz, 2019). Has potential to reach a vast area and enter new geographical markets (Castillo et al., 2021).

Capability to increase client base to new markets by transporting items previously unavailable via conventional cargo companies, such as meal delivery market, capability of delivering extremely fragile or oversized items, transporting pets or collecting clothes from the dry cleaners. Furthermore, by collaborating with businesses, the platform can be used as a marketplace for goods merchandise as CD platform can make product recommendations to its delivery clients (Gläser, Jahnke and Strassheim, 2021).

Companies that use CD gain a competitive edge by expanding their service offerings and distinguishing themselves from competitors, such as e-retailer Walmart leveraging in-store customers for crowd deliveries (Dayarian and Savelsbergh, 2020).

Another application is that, using an online platform to set up a customer network, courier express parcel service businesses using CD can differentiate themselves from their competition (Gläser, Jahnke and Strassheim, 2021).

Although it is repeatedly stated in the literature that CD is a revenue-generating model, how it creates profit is only defined by Rzeny-Ciepliska and Szmelter-Jarosz. They characterize the attractiveness of the revenue model as using a fixed pricing, resale margin, financing or matching fee, negotiated price, membership, reward, barter, discount and obtaining a part of the final revenue from the crowdsourced service (Cieplińska and Szmelter-Jarosz, 2020).

4.3.2. Crowd Delivery's Economic Sustainability Benefits for Crowd Couriers

Literature emphasizes that CD provides extra income to individuals who work as crowd couriers. CD provides the flexibility to generate additional income by driving activities in addition to individuals' core occupations (Li et al., 2019). In a scenario proposed by Du et al. in 2019, parcels hitchhike existing taxi rides. Appropriate food delivery requests are added to passenger ride queries. Taxi passengers can act as crowd couriers. In this scenario, passengers' riding fare can be decreased, and taxi drivers can earn extra income (Du et al., 2019). This way, crowd couriers can earn extra money and balance income fluctuates by adding income to their commute (Rechavi and Toch, 2020). Reduce their income insecurity by generating an additional source of earnings

(Torres, Gendreau and Rei, 2022).

Crowd couriers are compensated for each order they execute under the CD business model (Li, Wang and Rezaei, 2020).

Literature contains CD scenarios of crowd couriers who do not even use private automobiles. Passengers on metro, tram, and bus systems can perform crowd delivery jobs (Le et al., 2021). Local commuters or long-distance travellers who are already on the road are given the choice to gain revenues to help cover their travel costs by delivering things along the way or during their free time (Le et al., 2019). Payment for bringing parcels can be in the form of cash. Alternatively, instead of ready money, reduce trip expenses (Fessler et al., 2022).

Furthermore, CD information technology, such as machine learning algorithms, GPS systems, decision support systems, databases, and other support systems, help the crowd save money (Zhang et al., 2019).

Literature describes flexible working conditions of crowd couriership to be appealing for individuals.

In contrast to many other occupations, CD offers individuals flexible working conditions that allow for personalized work that is suited to their lifestyle (Buldeo Rai et al., 2017). Flexibility allows for self-defined working hours (Carbone, Rouquet and Roussat, 2017).

Crowd can distribute parcels on their way or in their own time by taking on dedicated or part-time work with a CD company (Le et al., 2019). CD provides an appealing sort of income generating for crowd couriers by allowing them to work at any time and from any location (Lee, Chang and Cho, 2022).

Starting from 2017 work of Carbone and fellow researchers, literature emphasize that CD creates new work opportunities for individuals (Carbone, Rouquet and Roussat, 2017). Individuals economically benefit from having additional job opportunities (Le

and Ukkusuri, 2019). It is also tempting that more job options are available with lower entry barriers for workers (Zhang et al., 2022).

Despite being mentioned only a few times, the literature implies that the CD business model is labour and workload friendly.
Consolidating transport amounts per trip reduced time-consuming labour and heavy workloads (Chen, Wang and Zhang, 2020). Drop-off flexibility, for example, overcomes the unattended home delivery issue for drivers, decreasing their workload, owing to CD's innovative operations management (Alharbi, Cantarelli and Brint, 2022).

4.3.3. Crowd Delivery's Economic Sustainability Benefits for Customers

Business customers can use CD to source or send products that are not available locally or by traditional shipping methods (Ermagun, Punel and Stathopoulos, 2020).

Retailers can improve their delivery services by CD (Ermagun and Stathopoulos, 2021). More delivery alternatives attract more clients since better delivery services are used (Le and Ukkusuri, 2019). CD platforms help smaller shops to expand their market reach, offer new services and improve firm competitiveness (Le et al., 2019). The crowd's decreased income expectations make CD more competitive (Le et al., 2021).
CD provides a reasonable pricing and access to all users, regardless of company size or location, making them more competitive (Chen, Wang and Zhang, 2020). Enables corporate clients to access a broader service area (Ermagun and Stathopoulos, 2021).
A potential to strengthen local businesses in the face of competition from online merchants (Voigt and Kuhn, 2021). Even if the brick-and-mortar store does not offer same-day delivery, in-store pickup of items by crowd couriers can create the possibility for same-day delivery (Gläser, Jahnke and Strassheim, 2021).

Restaurants and grocery chains, for example, may be able to shift to distribution hubs for online purchases because of this (Pourrahmani and Jaller, 2021). Restaurant industry has a lot of room for growth and expansion with CD (Lee, Chang and Cho, 2022).

CD allows retailers to provide convenient last-mile services to their customers (Buldeo Rai, Verlinde and Macharis, 2021). Allows business customers to provide convenience to their B2C clients by providing door-to-door delivery with variable scheduling (Ermagun, Punel and Stathopoulos, 2020).

Local stores benefit from CD's ability to supply quick delivery (Pourrahmani and Jaller, 2021). Even if the brick-and-mortar store does not offer same-day delivery, in-store pickup of items by crowd couriers can create the possibility for same-day delivery (Gläser, Jahnke and Strassheim, 2021). Providing restaurants with quick and precise service delivery choices (Lee, Chang, and Cho, 2022). Using passenger-occupied taxi rides, for example, for restaurant food deliveries resulted in speedier deliveries (Du et al., 2019). In summary, CD accelerates deliveries and can allow for same-day delivery (Ermagun, Punel and Stathopoulos, 2020).

CD enables retailers to provide flexible last mile services that can be transformed into personalized last mile services (Buldeo Rai, Verlinde and Macharis, 2021). Its adaptability allows for flexible delivery timing (Ermagun, Punel and Stathopoulos, 2020). Crowd couriers with flexible working hours are also ideal for restaurant food delivery services with obvious periods of highs and lows (Li et al., 2020).

Business customers improve their delivery efficiency, by using CD platforms (Bin et al., 2020). CD improves B2C delivery for e-retailers for example by offering same day deliveries (Sampaio et al., 2020).

Business customers applying CD to their last mile delivery operations can improve their consumers' satisfaction from their services, by improved delivery services (Ermagun and Stathopoulos, 2021).

Business customers applying CD to their last mile delivery operations gain the ability to provide their customers with increased delivery options by adding CD as an optional delivery to existing options (Le and Ukkusuri, 2019).

CD provides reduction in transport costs for business customers (Seghezzi et al.,

2021). Furthermore, it gives local businesses the chance to offer their consumers fast and inexpensive delivery even when they couldn't previously afford a logistics service provider or set up their own shipping network (Gläser, Jahnke and Strassheim, 2021). Businesses can reduce transport expenses for last-mile deliveries and same-day deliveries by using CD (Buldeo Rai, Verlinde and Macharis, 2018). Additionally local businesses can offer free, fast shipping to their clients as a result to cost savings from CDs (Pourrahmani and Jaller, 2021).

Customers of businesses supported by CD can benefit from same-day deliveries and high levels of customer services (Sampaio et al., 2020).

CD allows for shorter delivery times, same-day deliveries, flexible shipping, and customer reception for customers in in general, whether business or individual (Shen and Lin, 2020). By making deliveries more affordable for all customers, CD offers economic benefits (Yi et al., 2020). Additionally, all clients are able to be receiving superior services (Huang et al., 2020).

Consumers may access products through CD that are not offered locally or by traditional delivery service (Ermagun, Punel and Stathopoulos, 2020). Additionally, CD can offer a variety of options and providers at anytime, anywhere and for any route required (Rześny-Cieplińska and Szmelter-Jarosz, 2019).

As a result of CD's simple last mile services, individual clients may easily manage the pick-up and drop-off of their items, as well as the time and location of their deliveries (Punel, Ermagun and Stathopoulos, 2018). Moreover, offers clients convenience because it enables door-to-door delivery with customizable scheduling (Ermagun, Punel and Stathopoulos, 2020).

Since the recruitment of transportation begins immediately after the package delivery request is created, minimal waiting time is required. Since the hired vehicles typically deliver people quickly by selecting light-traffic routes from an origin to a destination, less time is spent on the roadways which provides faster deliveries (Chen, Wang and Zhang, 2020). Additionally, CD offers economical same-day delivery to individual

customers (Carbone, Rouquet and Roussat, 2017).

High levels of customisation for pick-up and delivery conditions are made possible by CD's flexibility (Punel, Ermagun and Stathopoulos, 2018). The flexibility of CD is a result of its customizable scheduling. Since each package delivery is handled, managed, and delivered separately, consumers can benefit from flexible deliveries based on their specific requests (Chen, Wang and Zhang, 2020).

New delivery options are offered by CD to certain customers (Ermagun and Stathopoulos, 2021). Customers are offered to take advantage from increased delivery services (Voigt and Kuhn, 2021).

The cost of a CD is lower than that of traditional shipping options (Le et al., 2019). CD cost savings are transferred to the client in the form of cheaper service pricing (Li et al., 2019).

Individual consumers receive superior service levels and enhanced service level performances due to high operational flexibility (Seghezzi et al., 2021).

Using communication technology, CD connects individual clients with crowd couriers which provides transparency in delivery process for the customers (Carbone, Rouquet and Roussat, 2017). The technological infrastructure of CD enables real-time delivery tracking (Buldeo Rai et al., 2017). As a result, delivery services can be transparently traced by individual customers (Punel and Stathopoulos, 2017).

4.3.4. Social Sustainability Benefits for Companies

Customers' trust is increased by CDSP platforms' secure online payment methods and capacity for direct interaction between couriers and requesters during the delivery process (Pourrahmani and Jaller, 2021). The CDSP platform naturally fosters a more community engagement between the business and its clients (Le et al., 2019). By taking environmental and social sustainability benefits into account, the CD notion improves CDSP enterprises' image (Buldeo Rai et al., 2017). Furthermore, businesses, CCs, and consumers are connected via CDSP companies, who act as a mediator

between these two networks (Rześny-Cieplińska and Szmelter-Jarosz, 2019). Additionally, CD promotes trust and simplicity because neither the customer nor the customers are involved in the specifics of the contract; instead, they just take advantage of the safety. Another advantage is the tracking of CCs that CDSP platforms offer, which increases the transparency of the delivery operations (Cieplińska and Szmelter-Jarosz, 2020).

4.3.5. Social Sustainability Benefits for Crowd Couriers

The social sustainability benefit of CD for crowd couriers is that it strengthens social networks and local communities (Nieto-Isaza, Fontaine and Minner, 2022). Through CD, CCs can interact directly with their neighbourhood (Buldeo Rai et al., 2017). By encouraging social relationships, CD can enhance overall community cohesion (Le et al., 2019). In the sense of making someone happy while traveling, CCs can gain social advantages from this altruistic experience (Carbone, Rouquet and Roussat, 2017). Additionally, CD offers CCs health advantages related to their modal choices, such as cycling and walking (Le et al., 2019). Additionally, individuals can benefit from options for flexible work with schedules that fit their lifestyle (Seghezzi et al., 2021). Additionally, take pleasure in working while they participate (Huang et al., 2020). Language obstacles that CCs may encounter are also made easier to manage by the simplicity of CD technologies (Alharbi, Cantarelli and Brint, 2022).

4.3.6. Social Sustainability Benefits for Customers

Businesses, CCs, and customers can connect on a platform provided by CDSP firms instead of doing it themselves (Rześny-Cieplińska and Szmelter-Jarosz, 2019). Communities are supported by CD because CDSP platforms can broaden community cohesion by promoting social connections (Le et al., 2019). Utilizing social networks also reduced customers concerns regarding privacy (Devari, Nikolaev and He, 2017). With simplicity and trust, tracking and transparency, and a voluntary nature since individuals can choose logistics services on their own decision-making, CDSP firm acts as an intermediary between CCs and customers (Rześny-Cieplińska and Szmelter-Jarosz, 2019). By adding a layer between CCs and customers, CDSP companies' intermediary role additionally present convenience (Akeb, Moncef and Durand, 2018).

4.3.7. Environmental Sustainability Benefits

By promoting eco-friendly modal choice instead of fuel powered vehicles, CD aims to minimize negative environmental impacts of deliveries, it advocates environmentally sustainable green supply chains (Wang et al., 2016). Reduces the need for additional journeys for shipping products by making use of the available unused capacity in vehicles (Miller, Marco Nie and Stathopoulos, 2017). Due to utilizing already-available resources like automobiles or other modes of transportation, mobile phones, etc. negative environmental impacts can be minimized (Szmelter-Jarosz and Rześny-Cieplińska, 2020). Enables minimization of negative impacts. Due to CD's effective resource integration, demand on the urban transportation system is reduced (Zhang et al., 2022). Reduces driver detours and geolocates deliveries to optimize delivery routes (Punel, Ermagun and Stathopoulos, 2018). Additionally, CD reduces repeated deliveries of the same products because of the "not-at-home syndrome" (Bin et al., 2020).

CD decreases traffic congestion by utilizing extra or unused capacity of transport (Li, Wang and Rezaei, 2020). By using already existing trips, reduces vehicles on the road and so accidents (Gatta et al., 2019). Using spare loading capacity in already existing trips also enables CD to reduce air pollution (Chen et al., 2017). Embedding deliveries in pre-existing trips also enables decreasing fuel consumption (Zhang et al., 2017). Additionally, reduced environmental pollution brought on by a reduction in waste from environment polluting modes of transport, such as tire wastes of vehicles (Szmelter-Jarosz and Rześny-Cieplińska, 2020). By increasing the effectiveness of urban logistical distribution and decreasing the emissions of pollutants including nitrogen oxides, PM2.5, and PM10 from freight trucks, CD lowers carbon emissions (Huang et al., 2020).

By involving individuals with pre-existing trips, CD contributes to better air quality as it involves less congestion. Furthermore, enables less noise pollution by leveraging existing trips (Chen, Wang and Zhang, 2020). Quiet transport modes such as bicycles and walking contribute to noise reduction (Cieplińska and Szmelter-Jarosz, 2020).

4.3.8. Economic Sustainability Risks for Companies

To engage a powerful network of crowd couriers, a powerful network of customers is required. A strong network of crowd couriers is required to draw customers to provide faster and less expensive delivery which creates a dilemma regarding balancing supply and demand sides for companies (Basik et al., 2021). The reason why it is difficult to establish this balance is that CCs are free to accept or reject deliveries and they set their own work hours (Castillo et al., 2022). Since online customer demand is stochastic, it is difficult to align supply and demand to the equilibrium state. In consideration of this, it is challenging to coordinate an uncertain supply to meet the stochastic demand for services (Wang and Xie, 2021).

For CDSP companies to be economically sustainable, it is essential to motivate and engage an appropriate number of individuals who are eager to participate in the system (Dayarian and Savelsbergh, 2020). However, it is challenging to deliver due to various obstacles outlined in the literature. Determining an adequate system of compensation is crucial because the majority of the crowd appears to be driven mostly by financial considerations while participating in the system (Gläser, Jahnke and Strassheim, 2021). Even though participation in crowd delivery is encouraged, given that it is still a relatively new business model, technological, managerial, and legal difficulties could discourage the long run crowd participation (Huang et al., 2020). Another key barrier cited in the literature on this subject is that the crowd is made up of a wide range of individuals with different requirements, which makes it more difficult for businesses to encourage initial and ongoing engagement (Voigt and Kuhn, 2021).

It is difficult to control an extensive database of crowd couriers with different preferences (Li, Wang and Rezaei, 2020). Furthermore, it is difficult to predict how many packages a crowd courier can deliver a priori because of the crowd's unknown features and the fact that they use various vehicle models with uneven sizes (Torres, Gendreau and Rei, 2022).

Due to their poor job commitment, crowd couriers could provide a risk to businesses because it could impair their ability to accomplish their duties. They may be floating resources because of the low entrance barriers and lack of job stability (Lee, Chang

and Cho, 2022). A simplified registration process that encourages crowd to sign up risks the service's quality and, consequently, customer satisfaction, endangering the CDSP companies' quality of service (Li, Wang and Rezaei, 2020). Due to the wide and unknown pool of crowds, which creates a great deal of uncertainty and makes maintaining a working relationship with crowd couriers challenging, CDSP firm loses some control over the overall process (Song, Hu and Xue, 2022). While offering crowd delivery services, it can be difficult to ensure scalable and reliable delivery procedures (Boysen, Emde and Schwerdfeger, 2022).

Although technology offers CDSP companies several advantages, it also has some risks, which are discussed in the literature. The digital workplace poses several significant concerns. Technical problems and worker isolation increases task requirements due to technological complexity. As a result of technological intensity, crowd workers tend to be extremely detached or estranged from their jobs, which results in low job involvement and a lack of commitment (Lee, Chang and Cho, 2022). Another important feature of technological infrastructure dependence of CD is that only individuals with a smartphone or computer who are familiar with apps and web-based services can access it (Pourrahmani and Jaller, 2021).

A fundamental component of crowd delivery is the voluntary nature of crowd couriers, who can accept or decline the logistics services they choose to provide (Cieplińska and Szmelter-Jarosz, 2020). Since crowd couriers' delivery service is unpredictable and varies across time and space during the day as well as from day to day, ensuring delivery capacity can be challenging (Savelsbergh and Ulmer, 2022). This supports the argument that large amounts of crowd courier flexibility are harmful for CDSP companies (Buldeo Rai et al., 2017).

4.3.9. Economic Sustainability Risks for Crowd Couriers

Crowd couriers undertake much of the expenditures conventionally incurred by traditional courier companies while undertaking delivery tasks (Devari, Nikolaev and He, 2017). The cost items are evidently highly varied as well.

Fuel, parking, and toll fees costs are not covered by CDSP companies, rather covered by crowd couriers. Transferred costs may potentially manifest as additional cost offers.

Some CDSP platforms offer commercial auto insurance to crowd couriers or encourage them to buy personal insurance (Pourrahmani and Jaller, 2021).

In densely populated urban locations where finding parking is hard, cause delays in deliveries and so delivery durations take longer than expected. Time to income ratio decreases because of such unexpectedly long delivery times (Pourrahmani and Jaller, 2021).

The number of orders a CC completes determines how much income they make; they are not paid a base salary (Zhang et al., 2022). Basic labour rights for the crowd, like the minimum wage, overtime pay, and unemployment insurance, are not provided by CDSP companies, raising security issues regarding CC income (Pourrahmani and Jaller, 2021).

Liability issues among couriers are caused by companies refusing to take on responsibility for drivers involved in accidents or for deliveries that are stolen, lost, or damaged (Pourrahmani and Jaller, 2021). To ensure the delivery of valuable things, CDSPs place the CC's credit card on hold until the delivery is completed, which we can classify as an economic liability for couriers (Pourrahmani and Jaller, 2021).

Some efficiency issues are discussed in the literature with regard to CCs. For instance, long-distance detours are frequently required by CCs to deliver packages, and these detours lower driver fee for effort (Cheng et al., 2022). Another instance is the fact that workers must manage new task requirements, such as informing clients of their arrival in real-time and managing proof of delivery digitally using technology, because of rising consumer demand for no-contact food delivery services (Lee, Chang and Cho, 2022).

Cultural and demographic challenges for CCs also involve risks to economic sustainability, according to research found in the literature. CDSPs reveal drivers' identities to increase customer trust, satisfaction, and repurchase intentions. However, it is found that these encouraging results hold true only if customers believe the crowd couriers to be like them, particularly in terms of ethnicity (Ta, Esper and Hofer, 2018). Cultural barriers may also have a negative impact on CC's economic situation. For

instance, in some regions, managing deliveries might provide uncomfortable circumstances for both parties due to interactions between opposing genders (Alharbi, Cantarelli and Brint, 2022).

Due to customers' powerful negotiating position, it is more difficult to pay CCs fairly (Yi et al., 2020). As delivery time, distance, size, and weight are not constant but rather vary from case to case, couriers' perceptions of cost depend on these variables rather than being fixed, CD platforms' fixed pricing is thus not always fair or attractive enough to satisfy or engage in new or existing couriers (Pourrahmani and Jaller, 2021). It is challenging for CCs to secure shipping orders in CD due to the low frequency of freight transport demands (Yi et al., 2020). Although having a flexible schedule can be beneficial to one's professional life, it's possible that the lack of job stability will work towards CC (Le et al., 2019).

4.3.10. Economic Sustainability Risks for Customers

Customers' perceptions of the retailers may be influenced by CDSPs sharing drivers' identities since consumers are more likely to trust, be satisfied with, and make repeated purchases when they think that the CCs are similar to them, particularly in terms of ethnicity (Ta, Esper and Hofer, 2018). Retailers who use CD as a new means of reaching customers give up some of their bargaining power to CDSP companies, which could result in a loss of control for the retailers (Carbone, Rouquet and Roussat, 2017).

Although CDSPs can track CCs due to the transparency benefit of CD, quality and service are more difficult to control and hardly guaranteed (Rześny-Cieplińska and Szmelter-Jarosz, 2019). Another issue is that, for population groups without access to transaction accounts or mobile device technologies, CD's digital infrastructure serves as a barrier to individual customers' access to its offerings (Le et al., 2019).

4.3.11. Social Sustainability Risks for Companies

The social risk of CD as a new distribution framework is caused by customers' lack of trust in the sharing economy and their limited technological acceptance (Upadhyay, Tewari and Tiwari, 2021). As a result of working with occasional and unqualified non-professional individuals to make deliveries, CDSPs are exposed to liability concerns

(Punel and Stathopoulos, 2017). Additionally, CDSPs may experience reputational problems because of CCs' non-professional position (Punel and Stathopoulos, 2017). Who is responsible if the CC damages the package and who is responsible if an adverse incident happens concerning the CC during delivery are two additional liability concerns (Gläser, Jahnke and Strassheim, 2021). Unknown crowd members are a significant source of concerns, increasing the likelihood that privacy problems will arise (Buldeo Rai et al., 2017). Another privacy concern for CDSPs is how recipients feel about sharing their addresses and purchasing habits with CCs (Gläser, Jahnke and Strassheim, 2021). The crowd's unidentified identity represents security concerns with vulnerability to criminal activity (Buldeo Rai et al., 2017). Reliability concerns arise as a result of CDSPs' reliance on CCs, their flexibility regarding their schedules, and their willingness to engage with the system (Ermagun and Stathopoulos, 2018).

4.3.12. Social Sustainability Risks for Crowd Couriers

In the literature, there are cultural issues related to the social sustainability of CD for crowd couriers. The interaction between individuals of different genders could embarrass customers and CCs (Alharbi, Cantarelli and Brint, 2022).

Road accidents and injuries may occur to cyclists and pedestrians who are motivated by the earnings they receive from CD tasks (Pourrahmani and Jaller, 2021). Further, due to the earnings' relation to the quantity of tasks completed within a specific time frame, CCs may be imposed for risky driving behaviours (Pourrahmani and Jaller, 2021). For CCs, CD job presents additional physical challenges because it requires them to move big parcels sufficiently quickly to complete deliveries on schedule (Pourrahmani and Jaller, 2021).

Due to CDSP platforms' sharing of CCs' travel information and the resulting vulnerability of their information to privacy leakage, CCs are subject to privacy issues (Wang et al., 2019).

CCs are subject to high levels of stress that are associated with a wide range of task requirements and the use of advanced technologies, especially concerning food deliveries (Lee, Chang and Cho, 2022). The virtual environment develops a sense of

detachment from and lack of dedication to work for CCs (Lee, Chang and Cho, 2022). In a virtual setting, there is also the likelihood that CCs could view deliveries as being much more complicated than they predicted (Lee, Chang and Cho, 2022).

Concerns about CCs' security, trust, and safety are additionally found in the literature as well. It is observed that CCs may be doubtful about online payments (Alharbi, Cantarelli and Brint, 2022). Additionally, CCs' social concerns include whether CDSPs will protect them from harmful customer behaviour and prevent them from transporting harmful or prohibited items (Pourrahmani and Jaller, 2021).

The lack of an employment contract makes it more difficult for CCs to maintain a healthy work-life balance by putting their work-life balance at risk (Buldeo Rai, Verlinde and Macharis, 2018). Additionally, it is stated in the literature that, work-life balance for CCs becomes challenging by customers' powerful bargaining position (Yi et al., 2020).

The absence of agreed-upon penalty guidelines and requirements while accepting delivery jobs causes CC's uncertainty issues (Wang et al., 2016). As a part of the sharing economy, CD lacks worker's rights regulations, which puts CCs at risks of uncertainty (Fessler et al., 2022). Last but not least, it is discovered in the literature that legal issues relating to intercity deliveries may arise since goods contained within the package may be legal in the territory from which it is shipped but illegal in the region to which it is being delivered (Le et al., 2019).

4.3.13. Social Sustainability Risks for Customers

In the literature, accountability of CD services is found to be an issue among individual customers (Buldeo Rai, Verlinde and Macharis, 2021).

Cultural issues are important for customers as well, as interactions between individuals of different genders can be uncomfortable for both customers and CCs in certain geographies (Alharbi, Cantarelli and Brint, 2022).

Individual customers, as well as CCs and CDSP companies, are seen to be concerned

about crowd delivery service liabilities in addition to customers reliability concerns (Punel, Ermagun and Stathopoulos, 2019). Lack of trust between customers and CCs due to the fact that couriers are often occasional and non-professional delivery force irregular causes a risk for service reliability for customers (Punel, Ermagun and Stathopoulos, 2018). The unprofessionalism of the CCs also raises questions about the safety of the items that they deliver (Szmelter-Jarosz and Rześny-Cieplińska, 2020). Additionally, the safety of customers receiving items may not be ensured (Du et al., 2019).

Continuing from the concerns arising from non-professional nature of CCs, individual customers have concerns with trust regarding leaving packages with regular individuals who are not necessarily employees of an acknowledged company, i.e., well-established courier companies (Pourrahmani and Jaller, 2021). Lastly, the problem with online payments has been identified as one of the problems preventing customers from trusting CD (Alharbi, Cantarelli and Brint, 2022).

4.3.14. Environmental Sustainability Risks

The environmental sustainability risks of CD are derived from potential rebound effects. Crowd deliveries may be less environmentally friendly because CD handles each parcel individually as opposed to consolidated traditional deliveries (Gläser, Jahnke and Strassheim, 2021).

According to the literature, crowds making dedicated journeys to deliver packages have a much greater environmental impact than conventional deliveries (Buldeo Rai, Verlinde and Macharis, 2018). Additionally, CDs who are motivated by financial rewards participate beyond their usual routine by using private vehicles, which diminishes any possible environmental benefits (Pourrahmani and Jaller, 2021).

Regarding mileage rebound effects, CDs driven by compensation fees lengthen detours, cancelling any potential environmental benefits (Pourrahmani and Jaller, 2021). Additionally, the advantages could be jeopardized by increased travel and fuel use (Punel and Stathopoulos, 2017).

The mode of transportation that is used to make deliveries affects how environmentally sustainable CD is; deliveries made by car have more negative externalities than traditional deliveries from environmental aspect (Simoni et al., 2020).

CHAPTER 5: SYSTEMATIC LITERATURE REVIEW AND SEMI-STRUCTURED INTERVIEWS CONTENT ANALYSIS FINDINGS COMPARISON RESULTS

SLR and semi-structued interviews' content analysis results for sustainability benefits and risks are comperatively presented in this section.

Validated criteria refers to the criteria which are found in the interviews to be consistent with or identical to the criteria identified in the literature.

Transformed criteria are semi-structured interview content that is found to be contradicting with the literature. Some benefits stated in literature are not found to be applied in the field, on the contrary their absence are found to be causing risks. Furthermore, analysis comparison revealed that some criteria outlined as risks in the literature are transformed into benefits by implementing some safety measures.

New criteria are entirely novel or indicated as a risk or benefit in the literature for another stakeholder than those described in this thesis.

Izmir University of Economic Ethical Board Approval, Semi-Structured Interviews' Participant Information Form, Semi-Structured Interviews' Participant Consent Form and Semi-Structured Interview Questionnaire are included in Appendix A, B and C consecutively. Detailed semi-structured interviews' content analysis coding, including third orders and criteria are presented in Appendix E.

5.1. Comparison Results of Economic Sustainability Benefits for Companies

Validated economic benefits for company results reveal that higher delivery efficiency, reduced costs and transparency criteria shows consistency. Third order codes demonstrate that improved CD features, such as a lower delivery failure rate, result in higher delivery efficiency for CDSPs. By paying modest compensation to couriers for deliveries, the company can release itself from financial obligations to pay for employee health care costs and other employer social obligations while reducing depreciation, fuel, fixed, fleet, and human resource costs. As a result of this, CDSPs'

transfer of the full business risk to the crowd also demonstrates consistency with the literature. One other benefit that is supported by the literature is that CD technology infrastructure makes it possible to track deliveries, which increases operational transparency.

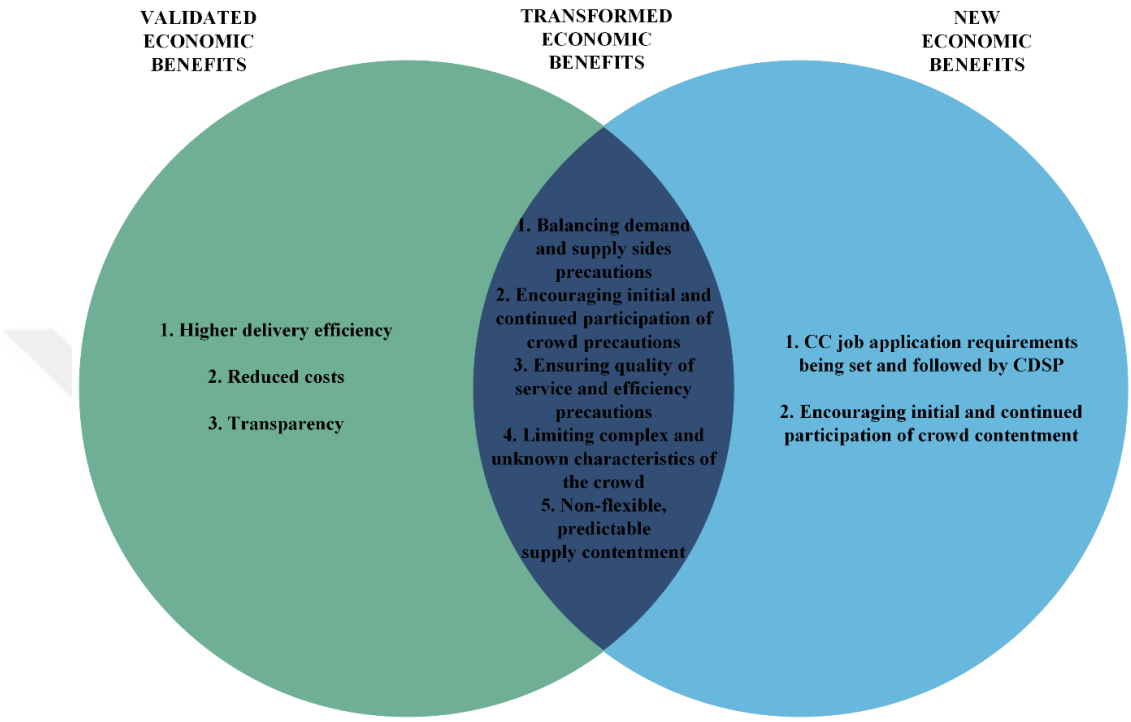


Figure 13. Comparison Results of Economic Sustainability Benefits for Companies

Transformed economic benefits for company results reveal that, balancing demand and supply sides, encouraging initial and continued participation of crowd, ensuring quality of service and efficiency, managing complex and unknown characteristics of the crowd as well as voluntary, flexible and uncertain supply criteria conflict on economic sustainability. Despite the fact that the literature has classified each of these as a risk, the interview content analysis suggests otherwise.

By planning delivery territories and pick-up locations in advance, matching crowd couriers to fixed areas, and making delivery capacity known to the company, businesses can balance the demand and supply sides in the field. CDSPs additionally take measures to promote initial and continued crowd engagement by guaranteeing income equity and by promoting crowd participation by paying them more than payroll couriers. By performing assessments of the CCs' quality of service and notifying them

of their performance, CDSPs in the field promote efficiency and quality of service. Such performance evaluations might result in positive or negative outcomes for CCs as receiving bonuses or contract termination. Furthermore, prior to beginning their work together, CDSPs make it clear what is expected of CCs through specific contract terms that specify delivery standards and punishment measures.

In order to ensure the quality of service, CDSPs make thorough identity checks of CCs during the hiring process. This prevents the participation of unidentified crowd members. By requiring CCs to own specified models of vehicles with uniform sizes, CDSPs in the field also limit the crowd's complex and unknown characteristics at the application stage. This makes delivery capacity known and simple to control from the start.

By defining CC's monthly working days requirements, an unchanging, predictable supply of delivery force is ensured. Additionally specified is the fixed range of CCs' daily working hours, ensuring that CDSPs' capacity for supply does not fluctuate from day to day. Additionally, restricting the self-selection of services by CCs to prevent the voluntary nature of CCs. Instead, CCs are required by the contract to finish all incoming shipments for their delivery zone on the same day that they arrive at the warehouse or cargo branch.

New economic benefits for company results reveal that, CC job application requirements are being set by CDSPs and can even be as detailed as to cover CCs' appearance to be "neat". The psychological attractiveness of running a business (as they own a sole preprietorship) encourages participation of CCs, which has the effect of promoting initial and ongoing engagement of crowd for CDSPs. This is another revelation of new economic benefits. Illustrated in Figure 13.

5.2. Comparison Results of Economic Sustainability Risks for Companies

Validated economic risks for company reveal that higher delivery efficiency, balancing demand and supply sides, encouraging initial and continued participation of crowd, ensuring quality of service and efficiency as well as technology accessibility and complexity can still create challenges despite the precaoutions taken on these

issues, detailed in 5.1. Section above.

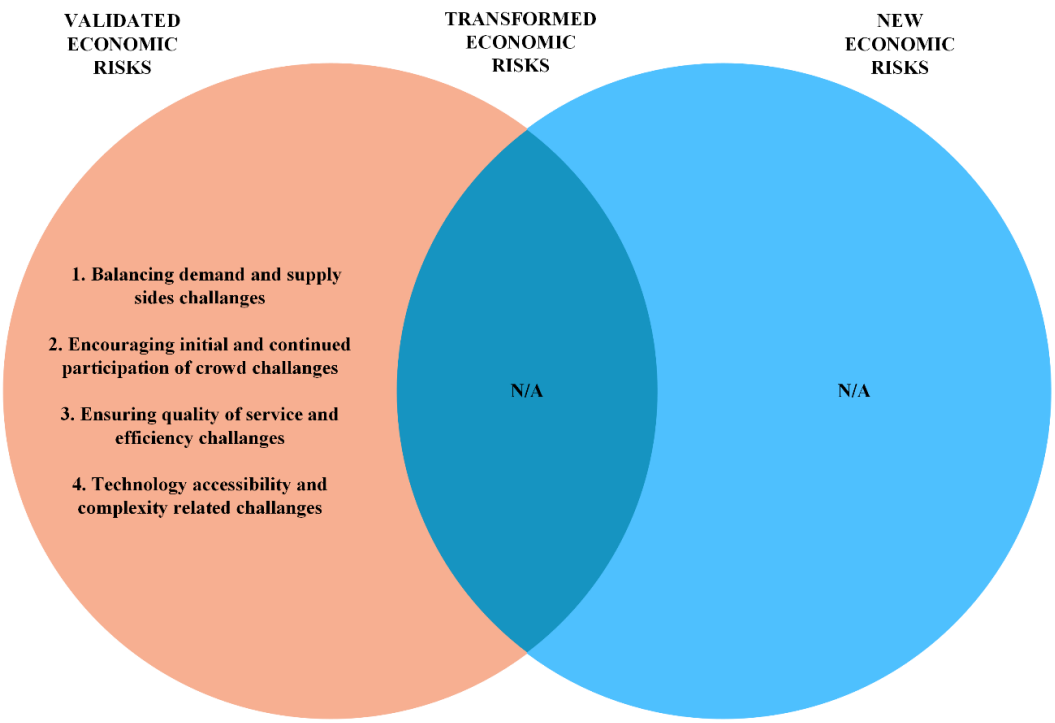


Figure 14. Comparison Results of Economic Sustainability Risks for Companies

Balancing the supply and demand sides due to the stochastic nature of freight transport demand, challenges are also effective in the field. Furthermore, due to the difficulty of creating a suitable compensation scheme to motivate and engage a sizable crowd with the variable and constantly rising vehicle investment costs, fuel prices, and other operational costs, encouraging initial and ongoing participation of the crowd can still be problematic. The expense to the crowd in terms of time, effort, and equipment discourages them from continuing to participate. Heavy workloads are being placed on CCs by crowd couriers who deliver packages to 80 addresses on average per day while working six days a week for an average of nine hours each day. In this regard, difficult working conditions compromise the effectiveness and quality of the services provided by CCs. In these situations, CCs use the assistance of friends and acquaintances to help with the delivery responsibilities in order to lessen the heavy workload. In this case, the involvement of crowd members who are unfamiliar to the CDSP adds a considerable source of stress to maintaining service quality.

As CC work is only available to people who own a smart mobile phone and are

accustomed to working with applications and web-based services, the human resource pool for CDSPs is constrained. Another concern associated with technology for CDSPs is that a lack of investment in technological infrastructure may result in system failures or delays, which may complicate operations and increase the amount and duration of work requested of CCs.

Comparison results do not reveal any transformed or new criteria relating to economic risks of CD for company. Presented in Figure 14.

5.3. Comparison Results of Social Sustainability Benefits for Companies

Comparison results do not reveal any validated criteria relating to social benefits of crowd delivery for company.

Transformed social sustainability for company results reveal that, liability, privacy, confidentiality, reliability, safety, security and trust criteria are conflicting. In the literature, it is stated that obligations are not made clear to crowd couriers before they begin working; nevertheless, in practice, obligations are adequately explained in contracts that are signed prior to the start of work.

Despite the fact that confidentiality and privacy are described as risks in the literature, we can see that there is awareness of these problems and that some steps are being taken to lessen the risks in the sector. For instance, CDSPs may take precautions to preserve the privacy of CCs by using mobile phone number masking to hide their phone numbers from customers.

Contrary to what is reported in the literature, CDSPs take action to guarantee the dependability of their service by continuously assessing crowd couriers' performance regarding their capacity to carry on with their work and meet their delivery commitments. Before starting work, CDSPs conduct identity checks on crowd members to reduce the risk of theft, loss, improper handling, or damaged packages. Additionally, it is revealed that checks for crowd identities and criminal records serve to avoid giving their clients any reason to be concerned about their vulnerability to criminal activities.

According to the literature, customers have trust concerns with businesses since they rely on amateurs to deliver the parcels. To increase customer trust in CCs' logistical capabilities, CDSPs in the field have started to request skill certificates from CCs, such as psychotechnical, SRC, and K certificates.

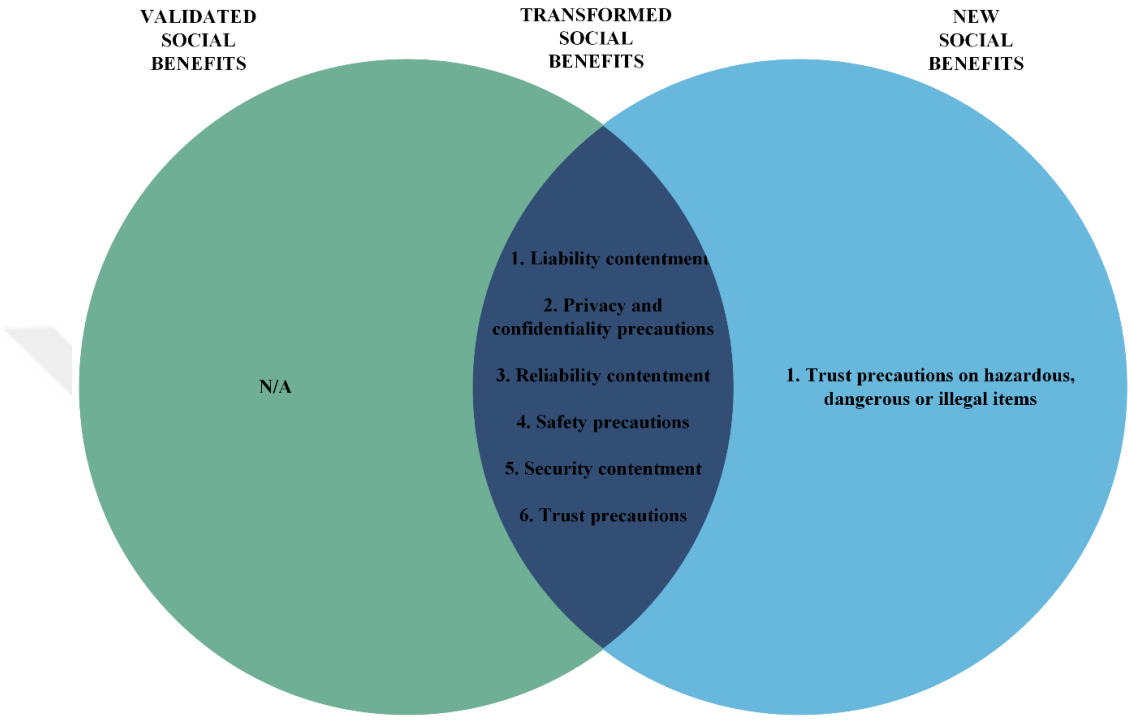


Figure 15. Comparison Results of Social Sustainability Benefits for Companies

Finally, it is made clear as a new social benefit that measures are taken to eliminate the risk of transporting harmful, illegal, or hazardous things by performing X-Ray controls at distribution centers before companies hand-in the parcels to the crowd members. Although not all of the businesses questioned take this precaution, it is clear that all of them are aware of the risk. Presented in Figure 15.

5.4. Comparison Results of Social Sustainability Risks for Companies

Validated social sustainability risk for company reveal that fostering acceptability, liability and trust concerns are valid in the field. Clients' disrespectful actions toward crowd couriers present a barrier to increasing CD adoption when CCs are not wearing CDSP-branded clothes or wrapping their vehicles with the CDSP badge. Because they must cover the costs of branding, CCs mostly reject it. CCs believe that by displaying these logos, they are promoting the business, and as such, believe that the business

should be responsible for covering these costs and even paying CCs extra for advertising.

Liability issues are also revealed to be present in the field. Crowd couriers mishandle deliveries due to their unprofessional behavior, which includes delivering items to customers without first requesting the CDSP delivery code. Packages may be delivered to the incorrect recipient or address.

Trust concerns regarding CDSPs are observed in lack of trust from consumers and also towards crowd couriers. Customers' trust in CC and, consequently, the business declines when CDSPs do not invest in CCs' company-related logo appearance. Concerns about safety, such as package loss or damage caused by crowd couriers, reduce company trust in CCs.

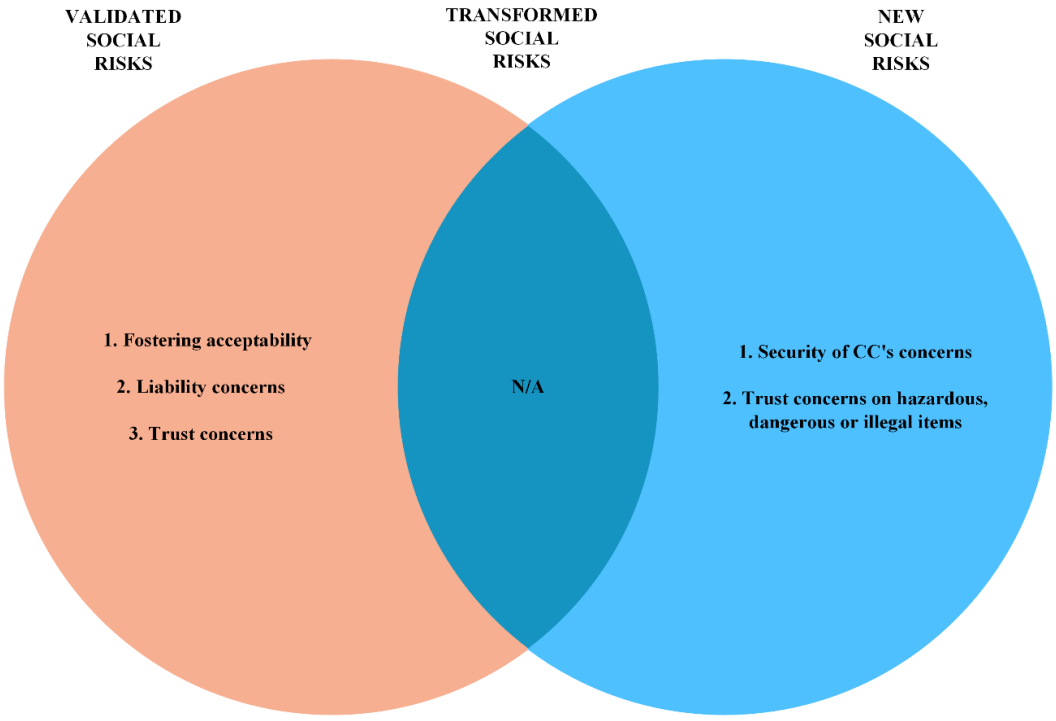


Figure 16. Comparison Results of Social Sustainability Risks for Companies

Although crowd-sourced courier services are thought to be a high-income source that promotes crowd engagement, package security becomes a concern because work requirements are not properly certified. Despite the fact that such underperforming crowd couriers are discontinued due to poor performance evaluation, risks are

encountered when they are in operation.

Comparison results do not reveal any transformed social sustainability risks for company.

New social sustainability risks results reveals that, lack of company investment in outfitting crowd couriers and wrapping vehicles with the company logo raises security issues by making it difficult to guarantee CC's protection against customers. Customers occasionally mistake CCs for theives and inquire as to whether or not they are working for the company in question.

Finally, some businesses in the industry have demonstrated a failure to develop trust in crowd couriers by failing to implement control measures, such as X-Ray checks of parcels at the distribution facilities, to prevent CCs from transporting hazardous, dangerous or illegal items. Presented in Figure 16.

5.5. Comparison Results of Economic Sustainability Benefits for Crowd Couriers

Validated economic sustainability benefits reveal that, crowd couriership generates more remuneration for couriers than being a paid courier in the traditional sense. Even though crowd couriers typically put in long shifts six days a week, there is a chance that their labor will be less time-consuming than payroll couriers'. Crowd couriers must deliver all items to their delivery area on the same day of arrival, however completing daily tasks quickly is made possible by quick delivery. Additionally, e-retailer CDSPs' well-organized delivery areas—small territories with a high density of packages—can cause CCs' daily operations to end earlier than expected. Due to seasonal variations in delivery numbers per day and diminishing demand in the summer, deliveries are completed faster.

There are less entry barriers for workers and more opportunities for crowd couriers to find work in some CD businesses because they are less stringent about vehicle technical requirements, notably regarding vehicle age.

Transformed economic sustainability benefits for crowd couriers reveal that, some

CDSPs active in the market cover crowd couriers' fuel expenses in part. The interviews revealed that several companies give either a minimum monthly income guarantee or, if the contract is set up as a per-package fee, a minimum number of packages per day is guaranteed to the CC. As a result, a finding that contradicts the literature on the subject has come to light because the corporation provides fundamental labor safeguards like the minimum wage and hence financial security becomes content. In the subsequent discussion on this subject, it became clear that even though the minimum number of guaranteed packages did not arrive for the crowd couriers' delivery region, the minimum number of guaranteed packages was still met by adding extra packages from the side regions to the crowd couriers' quota. As a result, the quantity of the crowd couriers' daily delivery tasks is unaffected by the frequency of the demands for freight transportation, and job stability is satisfied.

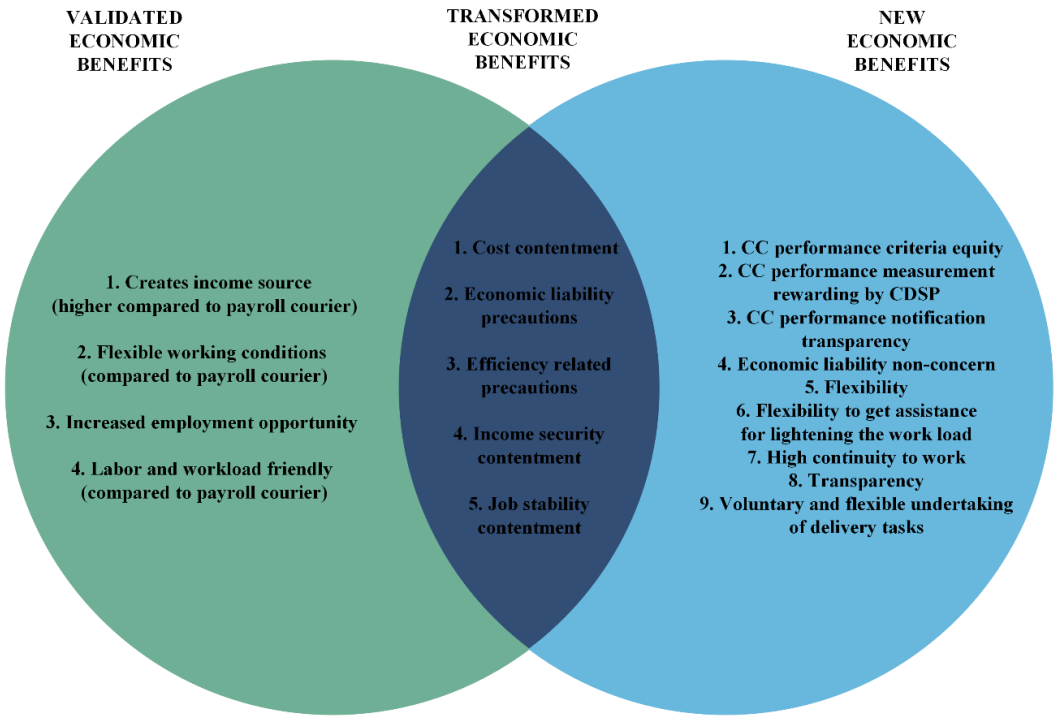


Figure 17. Comparison Results of Economic Sustainability Benefits for Crowd Couriers

Aditionally, prior to the parcels being CC's responsibility, CDSP takes steps against economic liability by returning the items that are identified as damaged to the senders. This prevents CC from having to bear a financial burden that was not their fault. In order to balance crowds' income-to-effort ratio, CDSPs fixes detour lengths and

meticulously calculates the distribution area and density in planning, before matching the couriers to their delivery regions.

New criteria results economic sustainability benefits for crowd couriers reveal that, the performance of CCs is continuously evaluated by CDSPs in the field, who primarily focus on the CCs' actual performance, such as their task completion rate and punctuality, both of which are acceptable to CCs. Some CDSP financially reward CCs for performing well. CCs can also receive promotion premiums based on favorable consignee evaluations. Every day or every month, CCs are transparently informed of their performance and whether the business is satisfied with their job. This information helps CCs improve their performance. In addition, by being transparent, they have the opportunity to clarify any misunderstandings that may have occurred during the assessments and jeopardize the accuracy of their performance evaluation.

With the exception of express crowd delivery firms and crowd courier supplier companies (CCSC), there are financial liability concerns over lost, stolen, or damaged parcels under CCs' embezzlement. CCSC and express couriers don't get their pay reduced in such unfortunate circumstances; instead, the sender grocery store, restaurant, or small business assumes responsibility and replacements the items. However, the crowd courier who makes an additional trip to deliver the replacement items is not compensated in any way.

Additionally, CCs working with hybrid fleet cargo companies and e-retailer crowd delivery companies in the field have the freedom to choose their own delivery route within their delivery region because they make daily deliveries rather than hourly or minutely, which allows them the freedom to choose their daily route. The only thing that the business considers vital in this regard is that all daily deliveries are made within the arrival date to the warehouse.

Although it is not formally allowed, in practice, CCs can reduce their monthly working days by agreeing to work on behalf of one another and reduce their working days. Here, attention needs to be drawn to the economic risk that this practice poses to the businesses as it decreases company's delivery capacity.

CCs have the option to reduce their workload by obtaining assistance for making deliveries by soliciting aid from friends and acquaintances for deliveries is not expressly forbidden by contract or is not strictly enforced. Here, we would want to draw attention to the fact that unidentified crowd members could become involved in the business, posing an economic risk to the company.

The fact that CCs earn as much as they work makes them trustworthy resources with dedication and incentive. It is also noteworthy that CDSPs ensure CCs' reliability in this regard by imposing financial penalties for tardiness or absence from work.

CCs benefit from real-time communication because CDSPs alert consignees through SMS when a CC is on the way so that they can prepare for the delivery.

Finally, it is discovered that express crowd couriers in the field have a unique accept-or-reject delivery choice that allows individuals to undertake delivery assignments voluntarily and on a flexible basis. Presented in Figure 17.

5.6. Comparison Results of Economic Sustainability Risks for Crowd Couriers

Validated economic sustainability risks for crowd courier results reveal that cost concerns of crowd couriers are valid in the field. Some CDSPs don't reimburse for fuel expenses, parking, or traffic tickets. Another problem is that, because CCs are typically required to work alone (and their income does not permit them to employ help), their revenue may decrease as a result of parking space shortages as they operate in crowded urban areas.

In crowd deliveries, crowd couriers are responsible for paying company-transferred expenses like vehicle depriciation cost. If any threats come from the side of the customer and result in monetary losses, CCs are in charge of ensuring their own defense.

Digital platforms acting as a barrier for demographic segments without access to linked device technology or a transaction account (by smartphones or computers) is another economic concern that has been validated by the field research. Due to the fact that

CD is mostly built on mobile application technologies, crowd couriers can use them to receive notifications of deliveries, and deduct completed deliveries from their accounts.

According to crowd couriers' validated economic responsibilities, CDSP firms do not assume liability for CCs who are injured while on the job or for stolen, lost, or damaged packages that are under CCs' care (embezzlement). Another acknowledged economic risk for CC is that, CDSPs keep CCs' bills of guarantee for the duration of the CDSP-CC contract, in order to protect the company from any potential financial losses caused by that particular CC.

The fact that CDSPs do not offer overtime compensation since the agreement in the contract is to finish daily deliveries on the same day they arrive in the warehouse reveals that there are validated income security risks in the field. Additionally, because the CCs are sole proprietors of small firms, they are not eligible for fundamental labor protections like company-provided unemployment insurance. Per delivery fee agreements prevent CCs from having a base wage, and the amount of money they earn is based on how many orders they successfully complete.

As CCs daily delivery task quantities may depend on the frequency of freight transport demands, which seasonally vary as high in the winter and low in the summer, job instability is another confirmed economic risk.

Crowd couriers have a tendency to undervalue the value of their time and underestimate vehicle operating expenses prior to starting work, according to price exploitation risk in the field. Before and after they agree on their salary under the contract they signed with the CDSPs, their viewpoints differ. After they begin working and run into these problems, they confront the financial risk they have taken and understand the compensation may not be sufficient.

Transformed economic sustainability risks for crowd courier results reveal that instead of doing crowd couriership as a side or part-time occupation, CCs do it full-time. Their contracts with the CDSPs necessitate full-time labor, often six days a week except

Sundays. One respondent among the ten even said that his contract requires him to work every day of the week without any days off to rest. Daily shifts range from 5 to 14 hours and an estimated average of 100 delivery addresses every day, CCs in the field have a demanding workload. Three out of ten CC participants claimed that if e-retailers have a busy schedule or a campaign season, they may even have to work on Sundays.

Additionally, according to the contract, CCs' annual leave is not applicable, and they typically must work on public and religious holidays. Contrary to what is indicated in the literature, contract terms severely restrict the ability of crowd couriership to be a flexible job for individuals.

New economic sustainability risks for crowd courier results reveal that violation of contract conditions by the companies are identified in the field. For instance, one of the CC participants stated that the daily upper limit of delivery quantities agreed in the contract are 48 per day, but grocery store keep delivery quantities higher. As a result, CC is delayed in deliveries. Even if the delays are caused by the company's breach of contract, CC is penalized if these delays occur 3 times in a week, CCs income is deducted as a penalty.

Additionally, the contract specifies that grocery store deliveries are limited to a maximum weight of 30 kg per delivery; however, participant CC8 stated that the grocery store does not adhere to this restriction. Another example from the field comes from CC9 who works for a crowd delivery company in the B2C market. He claims that they unload the trucks in the warehouse in the morning, a task that typically needs to be completed by CDSP employees, and that this adds to the CC's workload even though they are not paid for it. Participant CC3, who works for a hybrid fleet courier company, claims that the highest limit for delivering package decimeters is occasionally exceeded.

According to the contract agreement, the receiver must come down and pick up any load that is over 10 decimeters; nonetheless, the branch manager pressures the CCs to bring all loads of packages to the receivers' doorsteps.

Four out of ten CC participants mentioned that good performance does not always result in rewards as another economic risk for CCs operating in the field. Economic sustainability is also at risk when performance measurement is based on factors other than delivery performance. For instance, consignees receiving unfair ratings and complaints that disrupt CCs' performance evaluation.

New findings include that economic risks can also be brought on by CCs' own actions. CCs may be floating due to the fact that their continuity to work may depend on their comparison between the CD businesses in terms of the amount of compensation they offer. Furthermore, it is found that some days they miss work because being a CC is a physically demanding and exhausting job, even though they don't do it on purpose. As a result, CCs act in a way that reduces the quality of their service.

Even if crowd couriers are made aware of the standards for accepting deliveries, they might not always follow them. For instance, theft issues occur when CCs simply leave the package on the consignees' doorstep rather than hand delivering it to them. Although CC2 claims that CCs are obligated to get the delivery code given to the consignees via SMS in order to prevent such an incidence, CCs continue to make wrong choices like these.

CCs often choose to work alone because of physical limitations imposed by their vehicles and financial limitations that prevent them from hiring assistance. Although it is found that there can be exceptions, CCs are generally required to work alone by the companies. As a result, it is apparent that CCs have no opportunity to lighten their demanding workloads.

In the section on social risks, which will be considered as a social issue that can contribute to traffic accidents, it is found that CCs' daily working hours rely on both their delivery quantity and speed.

Economic concerns are also raised by the fact that CDSP governs the contract terms unilaterally. CCs contractual duties for delivery, terms of employment, financial

commitments, and penalties for violations are unilaterally decided and are therefore final and cannot be changed.

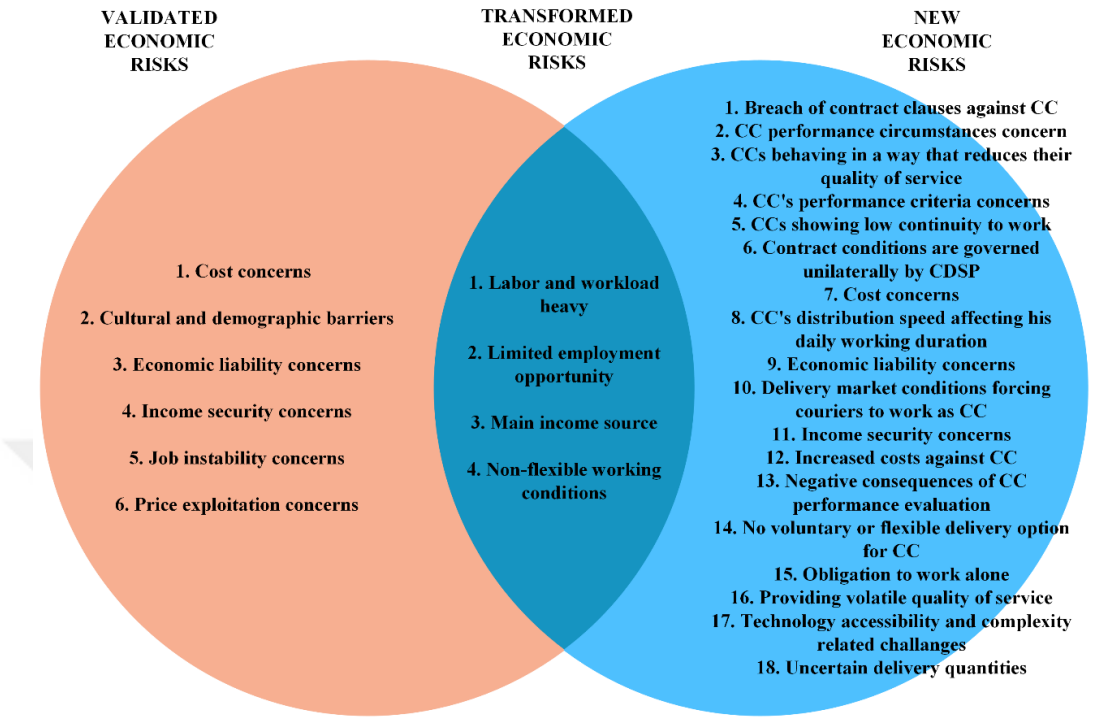


Figure 18. Comparison Results of Economic Sustainability Risks for Crowd Couriers

It is found that CCs's concerns about economic liability extend beyond the fact that businesses relieve themselves of liability for damaged deliveries. CDSPs also are not responsible to make payments for deliveries made to replace damaged goods with sturdy ones.

The content analysis reveals that the CC-CDSP contract leaves CC with no voluntary or flexible delivery options, such as working a set number of hours each day or working until all deliveries have been completed for the day.

Daily delivery quantities are not predetermined, and when CCs arrive at the warehouse in the morning, they are given their distribution numbers. CCs that pick up packages from grocery stores, restaurants, or small businesses are immediately aware of delivery orders, but they are also unaware of the number of deliveries each day beforehand.

The recently identified cost concern of CCs is that the crowd couriers are responsible

for paying CDSP's transferred costs. In crowd deliveries, the CCs are responsible for paying the fuel costs, vehicle depreciation costs, nutrition costs, and social security costs.

Additionally, there are other expenses that are not included in the contract, such as the added time and energy required to return to the warehouse for a second delivery slot during the day and customers who stall CCs while deliveries are being made which decreases time-to-income ratio.

Although CC performance evaluations assist businesses in the field better supervise processes, CCs' poor performance can result in financial loss, warehouse changes, and even the termination of their contract with the company.

Technology accessibility and complexity challenges are also an economic risk for CCs as it reduces their employment opportunities because CC jobs are only accessible to people who own a cell phone and are accustomed to working with apps and web-based services as CD delivery operations process is mostly carried out online.

Unfair customer reviews are also shown to have a negative effect on CCs' performance premium income. Additionally, regional supervisors who match CCs to delivery territories without knowing the locations put crowd couriers' revenues at risk. Presented in Figure 18.

5.7. Comparison Results of Social Sustainability Benefits for Crowd Couriers

Comparison results do not reveal any validated criteria relating to social benefits of crowd delivery for crowd couriers.

Transformed social sustainability benefits for crowd couriers' results reveal that crowd delivery does not have to be physically demanding, causing health issues. CC6, indicated that he chose to become a CC rather than a typical paid courier because of the light weight parcels of e-retailer crowd deliver firms.

Another transformed benefit finding is that the presence of penalty and

requirement guidelines that are acknowledged to them before the work begins remove the uncertainty issues of CCs.

Finally, as indicated by CC 2 and CC4, trust precautions connected to carrying hazardous, dangerous, or illegal items are typically taken in the field by X-Ray control systems at the distribution centers. As stated by CC3 and CC9, receiving cargo branches also inspect the contents of the parcels before accepting them for delivery. The grocery store confirms to the CCs' that such items are not included in the deliveries as CC10 stated.

New social sustainability benefits for crowd couriers' results reveal that, while it is true that customers have reservations about providing their personal information with CCs, there is no evidence in the literature that CCs face the danger of disclosing customers' personal information. It is identified in the field that CDSPs are implementing security measures to protect both the CC and customer sides by restricting the exchange of personal information, such as the implementation of phone number masking to both sides when they interact via their own phone lines.

In the literature, it is mentioned that trust issues between crowd couriers and the company arise from safety concerns brought on by the loss or damage of items by CCs. However, examination of the interview content demonstrates that CCs are a dependable delivery force in general. On the contrary, theft incidents are brought on by third parties. Nevertheless, it is observed that CCs that violate package safety are quickly removed from the fleet.

Senders and receivers are both content with CCs because they cannot begin employment without obtaining documentation such as credentials, a clean criminal record, or housing information. Aside from that, we've noticed that CCs that violate customer security are being removed out of the fleet.

Additionally, it has been discovered that individuals are psychologically drawn to CC work since it allows them to feel as their own bosses and motivation of running their own business since they are sole proprietors.

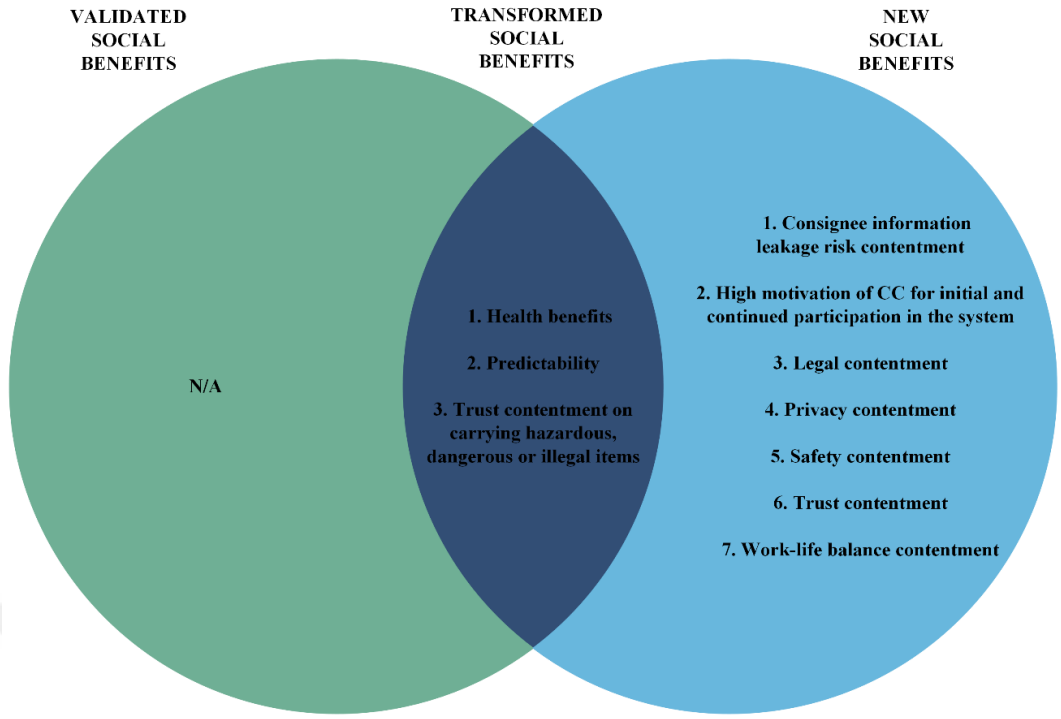


Figure 19. Comparison Results of Social Sustainability Benefits for Crowd Couriers

Even if this support is not confirmed by participants other than CC1, a CDSP has been identified in the field to provide legal aid to CCs as needed in the case of legal issues connected to CCs work time, such as disagreements with customers and similar scenarios.

Finally, CC1, CC2, CC4, CC5, and CC9 stated that, despite the fact that they typically have heavy workloads and long workdays, the job intensity of CC does not make it much difficult for them to balance their professional and personal lives. Presented in Figure 19.

5.8. Comparison Results of Social Sustainability Risks for Crowd Couriers

Validated social sustainability risks for crowd couriers' results reveal that, health, privacy, technology complexity, trust and uncertainty are concernin issues.

Health issues include motorcycle riders' road injuries since they are more likely to be involved in accidents. CC employment can be physically demanding in some circumstances because CCs may have to carry heavy items. According to CC4, despite having a maximum delivery weight limit of 15 kg, he brings cat litter, which is

substantially heavy, to the customer's doorstep rather than argue with them.

The privacy of trip information of crowd couriers has been found to be at risk in practice; since CC1, CC7, CC8, CC9, and CC10 all stated that the CDSP system allows for real-time delivery tracking by the clients.

Security concerns are also identified in the field. Receivers' argumentative attitude cause security concerns for CCs in the field. CC8 stated that some customers are inclined to react for slightest problems in an argumentative manner.

Complexities caused by technological updates/downtime are likewise a validated risk. According to CC2, CCs perform their duties by collaborating with the delivery application on their mobile phones. In an instance, the application system crashed and went into maintenance one day, and regardless of whether this was an extraordinary scenario, he had to work 6 hours longer that day.

Content analysis validates trust concerns about carrying hazardous, dangerous or illegal items. CC1, CC5, CC6, CC7, and CC8 claimed that the company has no means to verify for or confirm CCs that they are not carrying any hazardous, dangerous or illegal items.

Uncertainty issues identified by the interview content analysis are consistent with the literature, since there may be ambiguity if the CC contracts are short and contain few clauses. CC8 indicated that he signed such a brief contract with the crowd courier supplier company, in contrast to all of the other participants who mentioned many clauses from their contracts during the interviews.

Comparison results do not reveal any transformed criteria relating to social risks of crowd delivery for crowd couriers.

New social sustainability risks for crowd couriers' results reveal that, CCs are concerned about their social security because they are solely responsible for their own security while working, for traffic disputes, for dangerous pets owned by receivers,

and for theft events.

Whether the literature mentions that the absence of an employment contract complicates crowd's working conditions and work-life balance, we see in the field that even if CCs have detailed work agreement contracts with CDSPs, they still have work-life balance concerns due to high continuity of work, lack of annual leave, working 6 days a week, and working on national and religious holidays.

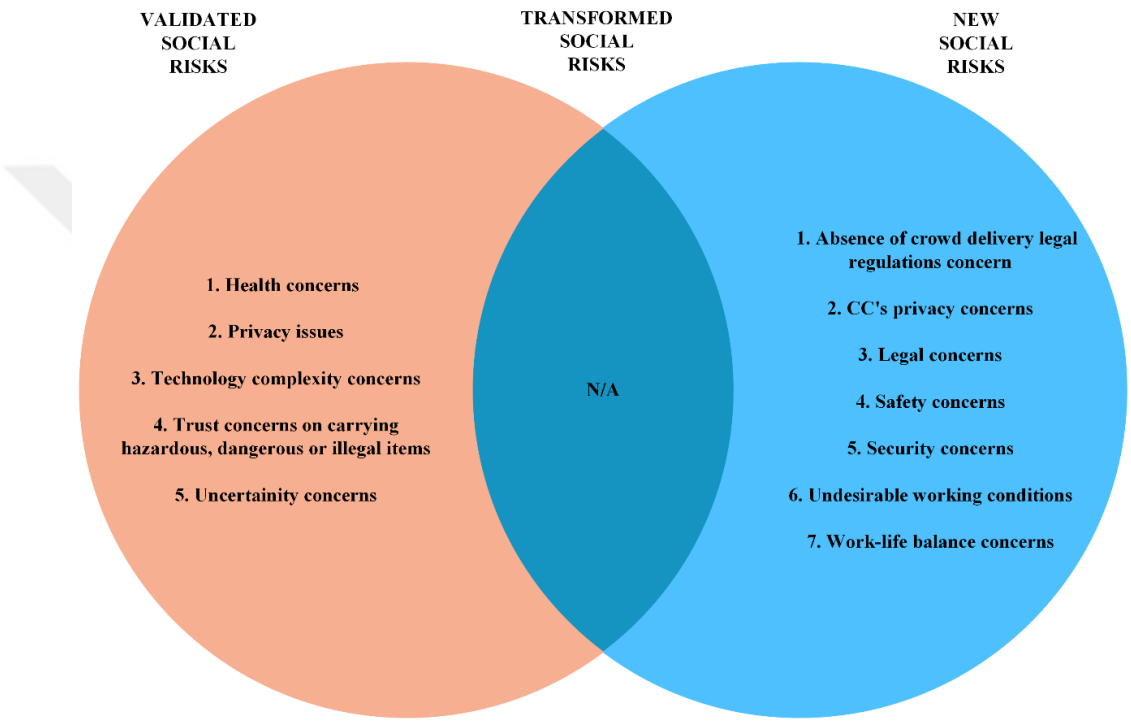


Figure 20. Comparison Results of Social Sustainability Risks for Crowd Couriers

Furthermore, legal, managerial, and technical difficulties could present social risks for CCs because crowd delivery is still in the exploratory phase. In this sense, CC5 called for legislation and rules to protect CCs. The unilateral nature of contracts with CDSPs, according to CC5 and CC7, is only intended to protect CDSPs and has to be amended so that liabilities are shared equally by the two parties. Additionally, they pointed out that these contracts reduced their entrepreneurial status to that of an employee.

Field investigation also demonstrated that CCs have privacy concerns. CCs who need to callconsignees on their cell phones in order to make deliveries are subsequently bothered by these consignees during their time off from work.

Except for CC1, all of the other interviewees, including branch managers, stated that CCs are solely responsible for resolving any legal disputes involving their work time and that their employers do not offer them any legal assistance. Examples of such disputes include disagreements with consignees or accidents in the course of making deliveries or while traveling to and from work.

CCs operation-related difficulties causing undesirable working conditions are also revealed to stem from organizing the packages into their vehicle according to their route, traffic density complicating their work, problems arising at work as a result of spending the entire day driving and not having access to restrooms, bad weather complexities - being too hot, too cold, or rainy- and traffic accidents they experience while working. Presented in Figure 20.

5.9. Comparison Results of Environmental Sustainability Benefits for the Society

Comparison results do not reveal any transformed or new criteria relating to environmental benefits of crowd delivery for the society.

Validated environmental benefits results for the society reveal that, crowd delivery provides environmental sustainability benefits to society by promoting small detours or minimizing detours by geo-location by matching CCs to delivery regions in accordance with a 5-kilometer diameter rule when determining CCs delivery region or by recruiting CCs to delivery regions close to their home addresses or by recruiting CCs to delivery areas based on package densities.

Furthermore, minimizing urban transportation pressure by saving on distance traveled by matching CCs to delivery regions where they will make less mileage in accordance with the savings on distance traveled approach. CDSPs allow CCs to favor delivery areas near to their home address or regions where they know the addresses very well in order to save on fuel consumption. Presented in Figure 21.

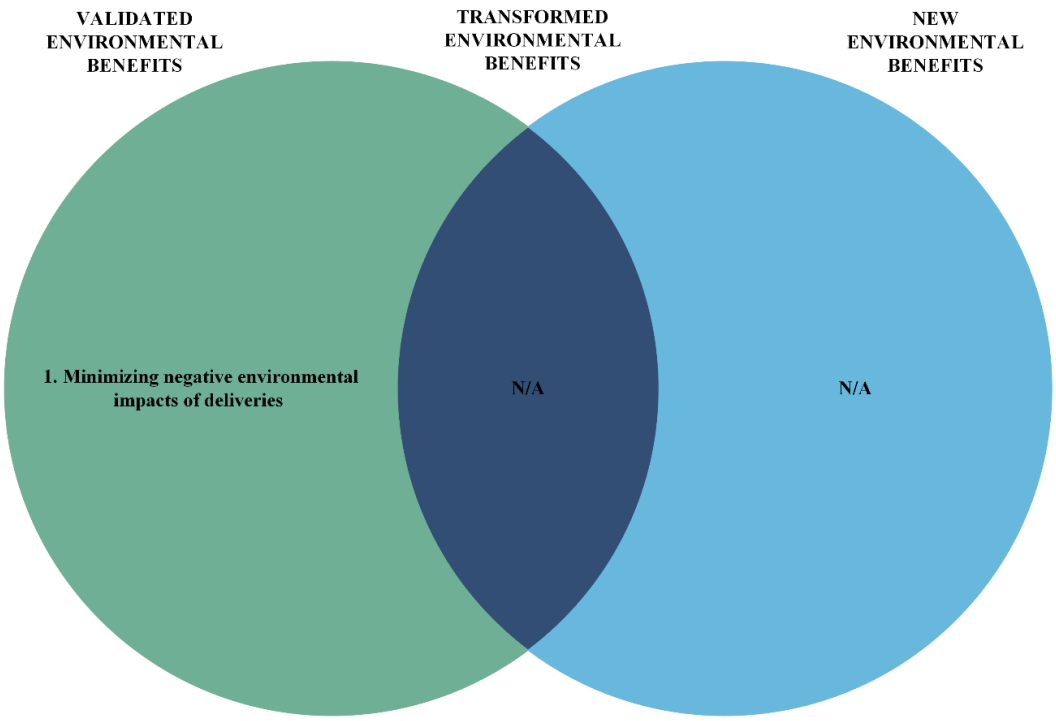


Figure 21. Comparison Results of Environmental Sustainability Benefits for the Society

5.10. Comparison Results of Environmental Sustainability Risks for the Society

Comparison results do not reveal any transformed or new criteria relating to environmental risks of crowd delivery for the society.

Validated environmental risks results for the society reveal that, crowd delivery presents environmental sustainability risks to society regarding rebound effects of modal choice as car-based CD entails higher negative externalities for traffic and environment than traditional deliveries. CDSPs are prerequisiting CCs to own panel van type of vehicles for deliveries and this obligation further risks the environment. Furthermore, as BM 3 stated that, General Directorate of Highways prohibits CDSPs to work with CCs having vehicles older than 5 years to protect the environment against exhaust emissions and pollution.

Nevertheless, CC1, CC2, CC3, CC9, and BM2 stated that CDSPs act flexible on this issue and tolerate CCs having vehicles older than 5 years. Presented in Figure 22.

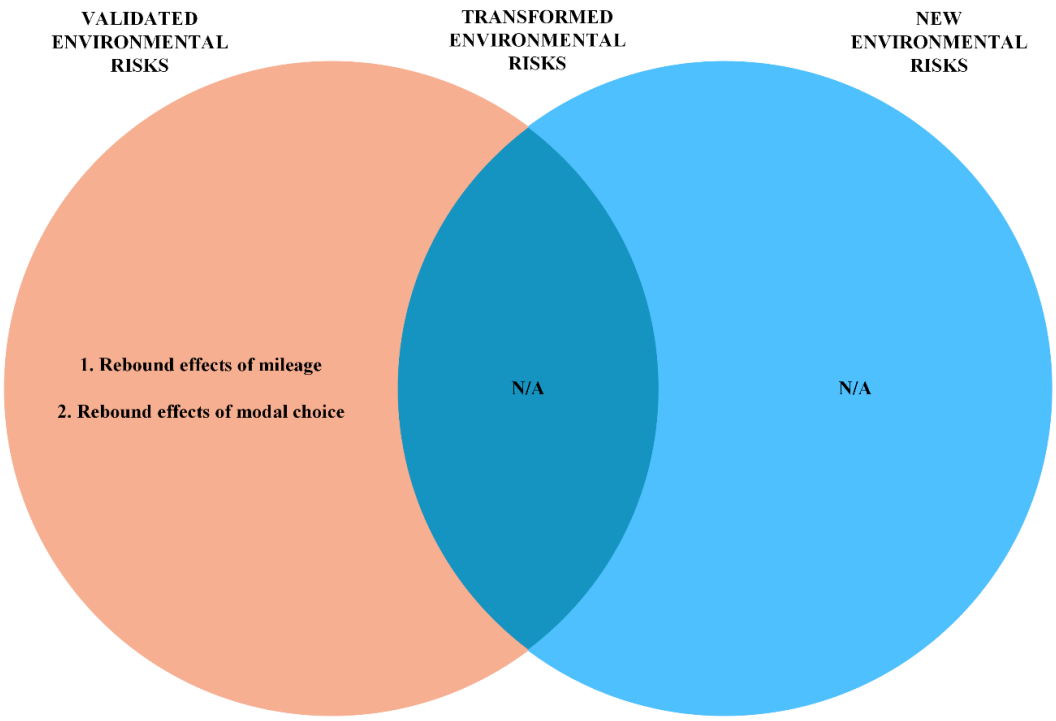


Figure 22. Comparison Results of Environmental Sustainability Risks for the Society

5.11. Discussion

This thesis examines economic, social, and environmental sustainability (full sustainability) that within the framework of Stakeholder Theory, based on crowd delivery literature and interviews with crowd couriers and crowd delivery company representatives. Crowd couriers are referred to as suppliers in this thesis since they are the delivery force that CD business relies on to carry out last-mile deliveries for customers but who are not company's employees.

Crowd delivery literature, validated, transformed and newly identified sustainability benefits and risks of crowd delivery businesses are discussed in the following.

On the literature, from a Stakeholder Theory perspective, current studies in the literature have a narrow and service providers' economic success focused perspective on crowd delivery sustainability. For a broader perspective on the subject, economic, social and environmental value creation for stakeholders needs to be better employed. Additionally, the available studies do not examine whether the actual distribution of the economic advantages makes each stakeholder better off and whether the process of allocating the financial value created is fair. Customers are mentioned to be satisfied

with reduced delivery prices, but suppliers are simply stated to be receiving small compensations for delivery tasks (Schaltegger, Hörisch and Freeman, 2019).

The currently used quite narrow research of crowd delivery sustainability therefore runs the risk of having a single actor focus and ignoring the stakeholder groups mostly (Schaltegger, Hörisch and Freeman, 2019).

It is evident that there are significant differences between the literature, existing business practices, and the suggested standards for full sustainability. Despite this very significant discrepancy between present behavior expectations and actual behavior, it may be argued that all actors have a moral duty to pursue complete sustainability. Strengthening the positions of interested parties is crucial in this regard.

Although there isn't a mention of ethical issues in the crowd delivery literature, they have an impact on the long-term viability of the company. Further, the authors need to ensure that environmental and social implications are incorporated into sustainability besides economical. According to the theory, the companies' well-being in the long-run will be achieved if the organization manages to endlessly satisfy its stakeholders. We will proceed to assess the sustainability risks and benefits in the following section by framing them within the Stakeholder Theory and making propositions for improving CD sustainability.

On validated benefits and risks; it is found to be complying with the literature that freight transport demands are stochastic, which makes balancing demand and supply sides challenging (Wang and Xie, 2021b). Time, energy and equipment costs incurred by the crowd workers may discourage continued participation as last mile delivery is an intensive form of work and crowd workers bear many of the operational costs (Huang et al., 2020). These are common risks due to the nature of the last mile delivery business and the logic of crowd distribution, but examining them solely from the company's perspective would be an insufficient approach to sustainability of CD businesses within the framework of Stakeholder Theory.

Research proposition 1: The costs beared by the crowd members affect crowd

participation to the system negatively.

Also validated in the comparison that it is challenging to foster acceptability for new delivery models especially as the person in contact with the end customer does not have a corporate appearance (Punel and Stathopoulos, 2017). Which in return affects trust-building, between customers and crowd. Trust issues also arise between crowd couriers and company; risks and safety issues caused by loss or damage to goods (Huang et al., 2020). Moreover, crowds trust, safety and security concerns are also valid (Pourrahmani and Jaller, 2021). Their one-on-one or heard from their surroundings experiences of receiver/sender dangerous behavior and carrying hazardous, dangerous or illegal items are current risks. It is evident that, for the sake of supplier and customer stakeholders, businesses need to consider investing in their suppliers regarding visualizing their relation with the corporate company (logos and branding). Crowd couriers are required to pay for the branding materials, despite the fact that they believe the situation to be advertising for the corporation, for which they should be compensated. This issue, which causes a social problem, should be addressed in order to eliminate social risks for all parties involved. During the fieldwork, it was discovered that the company's representatives are also aware of this challenge. As a result, any identification of stakeholders' needs and expectations, should be kept up to date on a regular basis from the higher levels of management.

Research proposition 2: Customer acceptance of crowd delivery is positively influenced by the crowd's corporate appearance.

It is validated that the service received from crowd couriers bring improved distribution efficiency and reduced delivery failure rate (Li, Wang and Rezaei, 2020). In the field, the source of these benefits is identified as to be companies' high entry barriers, detailed contracts on liabilities, requirements regarding deliveries and continuous crowd courier performance evaluation. Again it should be mentioned here that relationships are not one sided and during these regular assessments stakeholders perspectives also need to be assessed for higher value creation from the relationships with the stakeholders.

Research proposition 3: The performance of delivery companies is positively impacted by contracts between companies and crowd couriers that specify the requirements for service.

As company transfers all the business risk to crowd couriers CD business have reduced costs compared to traditional cargo companies (Carbone, Rouquet and Roussat, 2017). Also, reduced human resources costs as the crowd remains external to the company, companies pay small compensations for deliveries, have no employer commitments and obligations (Buldeo Rai et al., 2017). Couriers cost concerns are also validated as company's transferred costs are borne by the crowd couriers. Also confirmed that CD work creates higher income for the couriers compared to payroll couriers. Nevertheless, couriers have price exploitation concerns as their revenues erode with rising costs of service. Couriers in the field have stated that they underestimated the vehicle running costs and worth of their time prior to starting work (Voigt and Kuhn, 2021). Since the most emphasized subject in the fieldwork is that this burden of responsibility bends the back of the couriers, careful studies and considerations must be made to ensure that this transfer of responsibility does not result in corporate actions conflicting with this stakeholder's interests.

Research proposition 4: Companies' failure to adjust compensations in accordance with rising expenses has an adverse effect on crowd courier revenues.

Technology accessibility and complexity related challenges are also validated as CD work is only accessible to individuals who own a cell phone and are accustomed to working with apps which both limits company and couriers as decreasing the pool of workers and job opportunities (Le et al., 2019). Further, technical difficulties are validated to lead to increased task requirements for the crowd and also complicate operations of the company (Lee, Chang and Cho, 2022). Since it is an issue that affects both the company and the supplier negatively, it has been identified that it is an issue that needs to be considered for both parties.

Research proposition 5: Lack of technology accessibility has a negative impact on the supply of crowd delivery force.

Minimizing negative environmental impacts of deliveries by minimizing detours are validated by courier-delivery region matchings in the field which lowers fuel consumption, reduces urban transport pressure and helps savings on distance traveled. Nevertheless rebound effects of modal choice is also validated as motorized vehicle based delivery is encouraged and furthermore obliged by the companies which might offset the benefits (Simoni et al., 2020). In order to lessen the burden of crowd delivery operations on society as another stakeholder, organizational regulations that result in the internalization of external consequences may play a significant role. For instance environmental footprint detection, obliging hybrid or electric vehicles instead of fuel consuming may be encouraged within the companies. It should be mentioned that both the company and supplier sides of crowd delivery are responsible for resolving the existing issue. Stakeholders' contribution and involvement in this regard is crucial for joint solution generation. According to Stakeholder Theory, shared value creation implies that the connections between the focal company and its stakeholders must be more than transactional. In fact, creating value with stakeholders necessitates not only a common goal but also an appreciation for the stakeholders' active involvement. (Freudenreich, Lüdeke-Freund and Schaltegger, 2020)

Research proposition 6: Effective crowd courier-delivery territory matching has a positive impact on environmental sustainability.

Research proposition 7: Motorized vehicle based crowd delivery affect environmental sustainability negatively.

On transformed benefits and risks; balancing demand and supply sides challenges are limited in the field as opposing to the literature (Basik et al., 2021). Delivery capacity is known since delivery zones are predetermined, crowd couriers are matched to these areas, and CCs are required to distribute all of the parcels assigned to them on the same day. High income opportunity and CDSPs ensuring distributional fairness among crowd couriers encourage CC continuity. Ensuring quality of service and efficiency challenges are eased by prohibiting unknown crowd members, clearing requirement and punishment guidelines in the contract signing period, assessing crowds' performance and notifying them on this regularly. When evaluated in terms of

Stakeholder Theory, a feeling of fairness among the suppliers is advantageous for CD businesses sustainability as it creates an ethical satisfaction.

Research proposition 8: Predetermining each crowd courier's delivery zone and requiring them to complete all assigned delivery duties on the same day makes delivery capacity known to crowd delivery companies.

Research proposition 9: Distributional fairness among crowd couriers has a positive effect on their willingness to continue working.

Liability uncertainties are issues mentioned in the literature for crowd couriers (Wang et al., 2016). These concerns are eliminated in the field by clarifying all to crowd couriers before they start to work. Managing complex and unknown characteristics of the crowd challenges are eased by crowd couriers have specific models of vehicles of homogenous sizes, which makes delivery capacity clear and easy to manage a priori companies limiting crowd couriers to have specific models of vehicles of homogenous sizes, which makes delivery capacity clear and easy to manage a priori. Therefore, eliminates low entry barriers for workers as these conditions limit employment opportunities. Nonetheless, extensive information exchange about job guidelines is a beneficial complement to Stakeholder Theory, outlining the fundamentals of the mutual relationship.

Additionally, reliability concerns of companies towards crowd are eliminated on the contrary to what is stated the literature (Ermagun and Stathopoulos, 2018). Crowd members are tied to work 6 days a week and 9 hours a day on average by the contracts, with no annual or sick leave. For these reasons, crowd's time and flexibility to accept or reject delivery tasks are highly limited as a result. Voluntary, flexible and uncertain supply related challenges mentioned in the literature are thereby eliminated. Consequently, labor and workload friendliness becomes transformed. Due to CC's fixed monthly working days and daily working hours, this limits the flexibility of crowd workers. High levels of consistency at work change CD's ability to function as a second source of income. In the industry, it is acknowledged that making CDs is the sole primary task. As a result, suppliers functioning in this environment run the risk of

losing their status as entrepreneurs and being constrained to working for only one company. In this sense, it becomes even more important for businesses to treat crowd couriers ethically.

Income security concerns also identified to be eliminated as participants confirmed that they either have monthly minimum income guarantee or daily parcel guarantee. Which in return eliminates job instability concerns of CCs mentioned in the literature (Yi et al., 2020). In the field, their daily delivery task quantity does not depend on the frequency of freight transport demands. In this regard, ethical and business decisions are not distinct phenomena. The type of value created is also affected by how businesses interact with their stakeholders (Freudenreich, Lüdeke-Freund and Schaltegger, 2020). It has been determined that this arrangement relieves the suppliers to a certain extent.

Research proposition 10: Crowd courier employment security is positively impacted by the guaranteed minimum monthly earnings and/or daily guaranteed package quantity.

Safety, security and trust concerns of companies also highly stressed in the literature (Ermagun, Shamshiripour and Stathopoulos, 2020). Which are concerns eased by making identity of crowd couriers known in the application period against risk of theft, loss, mishandled or damaged parcels and representing a source of stress regarding vulnerability to criminal activity against customers. Predicated on the principle that, although some stakeholders contribute to value creation processes (for example, suppliers), other stakeholders profit from the value created (for example, customers). (Freudenreich, Lüdeke-Freund and Schaltegger, 2020)

On newly identified benefits and risks; literature mentions encouraging initial and continued participation of crowd is a concern for the companies (Basik et al., 2021). Nevertheless, it is identified in the field that psychological appeal of owning a business through conducting CC work stimulates CC participation as they consider this as a feature of high importance. Another new discovery on this issue is that as crowd delivery is still in the exploration stage, legal challenges, management and technical

challenges may discourage continued crowd participation pose a risk for the companies, nevertheless CCs in the field is concerned for the absence of crowd delivery legal regulations for themselves. Which in return, imposes a greater ethical responsibility to company managers to uphold crowd couriers' rights.

Research proposition 11: The psychological draw of owning a business through CC work influences CC involvement positively.

Although contracts remove many uncertainties, they are unilaterally imposed on couriers by the companies. This gives the couriers the feeling, in their own words, that they are an employee rather than a supplier, when starting and continuing to work. In addition to the fact that the terms of the contracts have a lot of expectations on the couriers, it has also been determined that the companies are violated in favor of the courier. For example, having them do the work that is not expected from the couriers for free (unloading the truck) or being forced to carry heavy loads above the limit. In this instance, it is crucial to emphasize the significance of identifying the stakeholders. If an actor who is actually a stakeholder is mistakenly classified as an employee and corporate actions conflict with this stakeholder's interests, an organization may fail (Garvare and Johansson, 2010).

Research proposition 12: Crowd's entrepreneurial standing is negatively impacted by unilateral contracts imposed by companies.

CCs are identified to be concerned of the unilateral termination of contract by the companies. In relation, CC's performance criteria is an issue as it may also be based on biased customer feedback. Although customers are seen as the most important stakeholders of a company, it is important to strike a balance between all the stakeholders according to the Stakeholder Theory (Garvare and Johansson, 2010). Therefore, it is crucial to ensure that the customer is always right approach does not pose a threat to the other stakeholder.

Although privacy is mentioned to be a concern for the customers in the literature, in the field it is detected to be a concern for the crowd couriers as well (Buldeo Rai,

Verlinde and Macharis, 2021). It has been observed in the semi-structured interviews that companies are taking technical measures that protect both sides mutually, which is a satisfying precaution regarding the theoretical framework.

Research proposition 13: Crowd delivery businesses social sustainability is negatively affected when crowd couriers' privacy is not properly protected.

It is expressed in the literature that, time, energy and equipment costs incurred by the crowd workers may discourage their continued participation and effect economic sustainability of companies negatively and crowd have cost concerns regarding company's transferred costs (Huang et al., 2020). Nonetheless these costs are not defined in detail and comprehensively. CD is defined as an asset-light business model for companies as they transfer investment, fixed, fleet, fuel, vehicle maintenance, depreciation and human resources costs to the suppliers. All these costs are identified to be economic risks for the crowd in the field research. Vehicle insurance, crowds' nutrition and social security payments are also newly identified expense items for the suppliers. As a result, CD can be on the contrary defined as asset-heavy business model for the crowd. Although requiring couriers to form sole proprietorships legitimately justifies these cost transfers, a Stakeholder Theory perspective invites a discussion of the underlying reasons for stakeholders to engage in business operations, herein higher revenues than payroll couriers expected by the crowd. The majority of interviewees claimed that after deducting all expenditures from their income, they make the same amount as payroll couriers. Diverse perspectives on what constitutes value and what constitutes sustainable behavior must be suggested in this regard.

Trust, safety, and security concerns regarding work are also identified in the field but adding new criteria (Le et al., 2019). These issues are not much detailed in the literature and field research have uncovered some related threats for the suppliers, such as receivers' pets threatening CCs health, CC's being exposed to theft incidents during work commute, health inconveniences caused by working in a vehicle, and security concerns regarding disputes in traffic. It is important for companies to ensure that the business is managed in a way that does not threaten the continuation of the business, as all responsibilities in such matters are placed on the couriers.

The most significant distinction between literature and fieldwork is that couriers face high entry barriers and contracts must be signed prior to work starts. While these have advantages, they also puts a burden on the suppliers. At some point, both parties will benefit from the shared commitment for liabilities, economic as well as social. Furthermore, it has been recognized in the field that society faces ongoing environmental sustainability risks. It should be noted that the business and supplier sides of crowd delivery are both responsible for improving this current issue.

CHAPTER 6: CONCLUSION AND IMPLICATIONS

6.1. Conclusion

Achieving economic success, environmental protection, and social well-being all at once is necessary on the route to full sustainability (Lozano, 2008). As a result, when considering the present and future of organizations from a commercial viewpoint, we can assert that all three factors should be considered equally in order to build a more effective and durable structure in the modern world.

The necessity of adjusting to a constantly changing corporate environment while keeping up with advancements in technology and innovations are corresponding concerns of businesses. For instance, the current e-commerce boom is an illustration of this dynamic and how it affects business supply chains. E-commerce changed the way trade is done and necessitated changes in inventory and distribution planning consequently (Castillo et al., 2018).

LMDs are the most expensive for e-commerce supply chains since they involve small packages with several destinations. Furthermore, high expectations of online customers, including fast or even immediate delivery, call for strict LMD processes. In the evolving world of purchasing, companies are moving towards more effective methods of satisfying customers' expectations. The high costs of LMD operations have given rise to a number of distribution strategies, including crowd delivery (Seghezzi et al., 2021).

Another change in the business world is that, the role of stakeholders in corporate decision-making is rising, and it is widely accepted that managers must balance the interests of several stakeholders in order to create value in a sustainable and ethical way (de Gooyert et al., 2017).

Since "Stakeholder Theory" enables us to comprehend and categorize variables, with an emphasis on the relationships between actors and the development of views, crowd delivery in last mile delivery and sustainability is investigated in this framework to provide insight for higher value creation out of this novel LMD model (Govindan and

Bouzon, 2018).

Stakeholder Theory is used as a framework for comprehending and resolving three interconnected business issues: the requirement to link ethics and capitalism, the requirement to comprehend how value is created and traded, and the requirement to support managers in managing in a manner that addresses the first two issues (Parmar et al., 2010).

This thesis, with the findings of systematic literature review and semi-structured interviews comparison within this framework revealed; validated, transformed and new benefits and risks of sustainability of crowd delivery businesses which provides an outline for stakeholder issues to be aligned and addressed.

Validated and new risks findings of this research are highlighting chronic and therefore urgent issues and concerns on crowd delivery sustainability. For crowd delivery service providers these risks are outlined as balancing demand and supply, participation of crowd, quality of service and efficiency risks caused by crowd couriers. On the other hand, service provider companies' primary stakeholder crowd couriers are facing performance criteria concerns, unilateralism of contracts, cost concerns, economic liability concerns, income insecurity and price exploitation concerns caused by service providers.

Social sustainability risks are revealed to be fostering acceptability from customers, liability concerns and trust concerns caused by crowd couriers. For crowd couriers, social risks are revealed to be the absence of crowd delivery legal regulations, privacy, health, security, and trust concerns.

Environmental risks from the literature are also validatedated which are considerations on rebound effects of mileage and modal choice that are caused by motivation of compensation for crowd couriers and revenues for service providers.

The findings of this thesis also identified practices that turned some risks into benefits when compared to examinations in the literature. The most notable of these for service

providers is that with the detailed contracts that are agreed between crowd couriers and the company, guarantee monthly working days and daily working hours of crowd couriers unlike occasional and flexible work schedules investigated in the literature. Companies also benefit from ensuring quality of service provided by crowd couriers by performance assessments. Furthermore, unknown crowd members are prohibited by detailed personal identity and criminal record checks to ensure quality of service. Additionally, complex and unknown characteristics regarding carrying capacity is limited with the terms of these contract.

On the contrary to the literature, crowd couriers' uncertainty issues are eliminated in the literature. With the use of contracts agreed with the company prior to work starts, couriers can avoid uncertainties regarding the absence of punishment guidelines and requirements of delivery assignments.

The perspective and challenges of the couriers were thoroughly assessed. The branch managers, who function as the company's first point of contact with couriers, have confirmed the existence and magnitude of these challenges and benefits.

A company is defined in Stakeholder Theory as a system of critical relationships among individuals or groups who affect or are affected by its business operations. These various stakeholders provide resources, influence the business environment, benefit from the organization, and have an impact on both its efficiency and impacts. According to this viewpoint, the cumulative efforts of the stakeholder network are at the heart of value creation, and the withdrawal of support from any stakeholder might jeopardize the existence of a business.

This stakeholder perspective brings a new dimension to the debate of crowd delivery business sustainability by recognizing that relationships are the foundation of a functional value creation network. Stakeholders participate in connections with a focal business and its value production and exchange activities for a number of reasons, according to a relational approach. According to Stakeholder Theory, a joint purpose should come from a company's and its stakeholders' shared values, and so serve as a strong and inspiring reference point for joint value creation.

Failure to foster and sustain a sense of fairness as part of the stakeholder viewpoint on value creation may result in the withdrawal of stakeholder support, compromising the survival of the business model (Freudenreich, Lüdeke-Freund and Schaltegger, 2020). In conclusion, to build up better relationships between the company and its stakeholders and provide ground to create higher value, avoid ethical failures and advance sustainability, the findings of this thesis provides comprehensive content for crowd delivery businesses. Findings of this thesis may provide managers insights from the literature and the field.

Based on the insights gained from analyzing the contents from the perspective of Stakeholder Theory, we suggest that it is critical to investigate what commercial success truly entails in the context of business arguments for sustainability. Using Stakeholder Theory to solve this topic, it is suggested that success be defined as long-term value generation for many stakeholders (Schaltegger, Hörisch and Freeman, 2019).

Objectives from all three dimensions of sustainability—economic, environmental, and social—are derived from customer and stakeholder requirements (Seuring and Müller, 2008). In relation, it is necessary to continuously satisfy stakeholder demands in order to achieve sustainability for the organization. It should be recognized that stakeholder needs and expectations vary from organization to organization and throughout time. Therefore, any identification of stakeholders and their needs and expectations should be updated on a regular basis. (Garvare and Johansson, 2010)

6.2. Managerial Implications

Relationship between company and their stakeholders are focused in a manner to construct viewpoints and make suggestions for higher value creating decision making by CD managers.

To support managers in making more accurate decisions on how to deal with one of their companies' primary stakeholders who are crowd couriers', in-depth interviews and comprehensive content analysis are made. The findings gives voice to both parties and on many aspects support each other regarding sustainability benefits and risks of

crowd delivery practices.

Mutually supporting findings reveal that economic and social sustainability concerns are present due to conflict of interest. Furthermore, findings also reveals that these concerns are outweighing the crowd courier side. Crowd couriers' dissatisfaction from their revenues due to high cost bearings of their operations and high social insecurities are conspicuous. Additionally, crowd couriers' dissatisfaction from being treated by the companies as an employee rather than a supplier, business partner, creates risks on their continuity to participate in the system. The findings indicate that majority of the costs and social responsibilities are transferred to the crowd couriers by unilateral and final contracts. On the contrary, mutually supporting data reveal that field activities strongly assist the economic and social sustainability of companies rather than crowd courier suppliers.

In order to maintain and enhance the value offered by CD, managers should take steps to close this gap and lessen the strain on crowd couriers with regard to risks to the economic and social sustainability.

The environmental sustainability risks mentioned in the literature are also confirmed by both the courier and the company side in the interviews, that rebound effects of mileage and modal choice are highly present in the field. Since the foundation of the CD system depends on the completion of deliveries by couriers, we also urge CD managers to think about ways to enhance CD practices' environmental sustainability by encouraging green modal options and promoting occasional or part-time work schedules to utilize the regular individuals existing trips rather than promoting deliveries by fuel-consuming vehicles.

The findings of this thesis also identified practices that turned some risks into benefits in other and mostly developed countries that were examined in the literature. The most notable of these for service providers is that with the detailed contracts that are agreed between crowd couriers and the company, that that limits the ambiguity of supply, ensures quality of service provided by crowd couriers and avoid unknown characteristics of crowd couriers and anonymity. Additionally, for crowd couriers

uncertainties regarding punishment guidelines and requirements to be acknowledged regarding delivery assignments are avoided with these contracts.

Regardless of business location, detailed and specific managerial recommendations are listed in Table 11.

Table 11. Detailed and Specific Managerial Recommendations

Economic Sustainability Recommendations	Social Sustainability Recommendations	Environmental Sustainability Recommendations
Contracts can relieve stress on the amount of supply by fixing working days and hours of the delivery force	Detailed identification and security checks can resolve safety, security and trust issues among company, crowd and customers	Although companies cannot compromise delivery speed, they shall encourage green modes of transport (hybrid or electric vehicles)
Contracts can eliminate job instability for crowd couriers	Annual and sick leave right for the suppliers shall be supported by the company for any form of participation (part-time of full)	Environmental sustainability should not be considered only as the responsibility of companies, hybrid or electric vehicles that meet the technical specification should also be preferred by the couriers
Contracts can eliminate uncertainties regarding the responsibilities of crowd couriers and encourage participation	The business shall support suppliers' rotational time off for national or religious holidays for any kind of involvement (part-time of full)	
Crowd couriers shall be identified as stakeholders by the companies	Although the possibility of earning as much as working is attractive, reasonable upper limits should be determined considering the health risks and business continuity of the couriers	
Observing and assessing crowd couriers needs and perspectives shall serve to create higher value	Companies should consider the safety of couriers as a shared responsibility and invest and control in this regard	
Bilateral contracts and fairer sharing of liabilities may encourage initial and continued participation of crowd		
Allocation of financial value shall be made transparent to support fairness among the actors		

6.3. Academic Implications

To the best of researcher's knowledge, this is the first study that examines CD literature and focuses on its sustainability in such a comprehensive manner.

This study Validatedates the literature on sustainability of CD for companies, crowd

couriers, customers and society, outlines Validated, comflicting and novel criteria to the literature.

SLR results of this thesis reveals 12 research opportunities for colleagues interested in last mile deliveries, crowdsourced deliveries and CD sustainability benefits and risks. Furthermore, 6 of these research gaps identified in the literature are addressed in this study by utilizing qualitative methodology, conducting a field research, including parties involved other than companies, adopting a dyadic approach by involving company side and crowd courier side, focusing on social sustainability concerns and choosing the research location as a developing country.

The results indicate that most of the studies in the literature on crowd delivery are quantitative studies. The majority of studies focus on groundbreaking algorithmic prepositions to improve the technology foundation of crowd delivery firms such as to optimize delivery task assignment, supply and demand matching, delivery route planning and other technical issues. On the other hand, the literature lacks studies on the human aspect, which is at the core of this delivery method. The literature appears to focus on the company and ignore the economic, social, and environmental concerns of stakeholders in crowd delivery.

Findings of this thesis reveals that more qualitative study is required to better understand CD's features and functioning processes since it is an emerging business model. For such an intricate distribution system with multiple stakeholders, it is important to consider the importance collecting information from the field.
It is found that the majority of research concentrate on a single actor, the company, and mostly to enhance the financial earnings of the company. According to the highly regarded Stakeholder Theory, understanding the reciprocal relationships between multiple parties is crucial for creating a viable business model.

Social and environmental issues need to be addressed as well in the literature for crowd delivery to be fully sustainable.

In a vicious cycle, the locations of research are limited to advanced economies. In

order to address this research deficit, it is essential to look into CD initiatives and procedures in emerging economies.

This last mile delivery method seems to be very promising for all three sustainability pillars. In order to fully realize this potential, a detailed investigation of the practices and the distribution of the focus to the concerns outside the framework of economic issues will make a tremendous contribution to the literature. In order to put crowd delivery business sustainability in a larger context, social and environmental issues should be investigated for the stakeholders. Furthermore, ethical issues need to be studied in the crowd delivery literature for long-term viability.

6.4. Limitations and Future Research

Due to the limitations of this study, there are opportunities for further research.
First, the sample size shall be increased to include more participants from the courier and company sides, as well as managers at various levels can be included to get further insight.

Second, the Stakeholder Theory framework is used to examine the sustainability risks and benefits of businesses that use crowdsourcing for delivery services. Different examination aspects can be studied using diverse theoretical frameworks.

This study applied a dyadic approach to investigate businesses and couriers, which can be applied to other primary and secondary stakeholder pairings, or even enlarged to include multiple stakeholders.

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APPENDICES

Appendix A – Semi-Structured Interviews' Participant Information Form

PARTICIPANT INFORMATION FORM

Dear Participant,

The aim of the study is to examine the businesses of crowd delivery in the Turkish market bilaterally (cargo/delivery companies and crowd couriers) in terms of social sustainability and business durability. The questions cover the business model, the understanding of the resilience of the model in social issues such as occupational safety, occupational health, working conditions, safety and reliability.

In this study, you will be given an interview consisting of semi-structured open-ended questions.

Your participation in the research is voluntary, and you may refuse to participate in or withdraw from the research at any time, without being subject to punishment or sanction and without losing any rights.

Records that identify you will be kept confidential; it cannot be disclosed to third parties or the public; your identity remains confidential even if the results of the research are published.

In the interview, questions aimed at revealing the content specific to the company will not be asked.

Since your answers in the interview will only be used for academic purposes, it is not open to creating any content that may harm you or your company.

Yours truly,

Researcher information:

ELIF IZCAN

Izmir University of Economics Logistics Management Master's with Thesis student.

Appendix B – Semi- Structured Interviews' Participant Consent Form

PARTICIPANT CONSENT FORM

I have read the Participant Information Form created within the scope of the master's thesis titled "Investigating Crowd Delivery Businesses for Sustainability" conducted by Elif İzcan, a student of Izmir University of Economics Logistics Management Master's with Thesis Program, under the supervision of Assoc. Prof. Dr. Aysu GÖÇER, Faculty Member of Izmir University of Economics, and I am voluntarily participating in this research.

I consent to the use of all the answers I have given within the scope of the interview work for scientific purposes.

I have read and understood the above information in detail and I agree to participate in the interview.

Name and Surname

Phone number

Date

Signature

Appendix C – Semi- Structured Interview Questionnaire

DEMOGRAPHIC INFORMATION

1. How long have you been working in the crowd delivery business?

- 6 months-1 year
- 1-2 years
- 2-5 years
- More than 5 years

2. What type of company do you work for?

- Cargo company
- E-commerce cargo company
- Courier company
- Other If other please explain.

3. Which position do you work in the company?
4. What is your educational background?

- Primary school graduate
- Secondary school graduate
- High school graduate
- University graduate
- Graduate school

5. How many days a month do you work as a crowd courier?

- 1-5
- 6-10
- 11-15
- 16-21
- Other If other please explain.

6. How are the working days determined, according to what/whom?
7. How many hours a day is worked as a crowd courier?

- 1-3
- 4-6
- 7-9
- 10-12
- Other If other please explain.

8. How are working hours determined, according to what/whom?
9. To how many addresses are delivered per day by a crowd courier?

- 1-5
- 6-10
- 11-20
- 21-30
- More

10. What/according to whom and how are the daily delivery quantities determined?
11. How does working as a crowd courier affect your work-life balance?
12. How does working with crowd couriers affect your business?

INTERVIEW QUESTIONS

13. Do those who work as crowd couriers for your company also perform other jobs, or is this their sole form of employment?
14. Can you tell us about the reasons why you prefer to work as a crowd courier instead of traditional courier?

About Pre-Contract Prerequisites

15. How are pre-contract prerequisites different from traditional courier recruitment processes?

- What are the prerequisites expected from crowd couriers when applying for a job?
- Can you tell us about the important terms of the contract?
- What is the job description of the company for crowd couriers?
- How are the identity checks and confirmations of crowd couriers carried out?

About Contract Conditions, Working Conditions and Processes

16. Can you tell about the delivery pick-up and delivery processes of crowd couriers?

- According to what/whom and how is the working zone of crowd couriers determined?
- How is the distribution order determined, in accordance with what or to whom??
- When and how deliveries will be made are communicated from the business to the crowd courier?
- Where and how do crowd couriers pick up to distribute deliveries?
- According to whom/what and how are delivery route arrangement is made?
- Can you tell about the step-by-step process of picking-up deliveries for distribution and after picking them until delivering them to the customer (receiver/customer)?
- What means of communication are used between the company and the crowd courier

from the beginning till the end of delivery processes and how?

- Which kind of vehicles do crowd couriers prefer to work with and according to whom, and who owns the vehicle?
- If it is not required to work alone when making a delivery, the assistant working with the crowd courier is determined according to whom/what, in which aspects does the assistant provide support, what are their working conditions and who is responsible for these person/people and in what sense?

About Job and Income Security

17. How would you describe the job and income security of crowd couriers? (Monthly or daily minimum fixed income guarantee, number of packages guaranteed for delivery, guaranteed amount of income per delivery quantity and so on)

About Reliability and Service Quality

18. How would you interpret crowd couriers in terms of credibility?

- Would you evaluate crowd couriers in terms of arrival to work and work continuity?
- How would you interpret crowd couriers in terms of fulfilling their delivery obligations?

19. How would you rate crowd couriers in terms of service quality?

About Safety of Delivery Package and Security of Customer

20. How would you interpret crowd couriers on the security of delivery packages? Can you tell us about the problems and processes in this regard?
21. How would you interpret crowd couriers in terms of customer safety? Can you tell us about the problems and processes in this regard?

About Problematic Processes Experienced during Work and Their Management (Security, confidentiality, legal issues, financial responsibilities)

22. Can you tell us about the problematic processes encountered in the crowd courier business?

- What are the factors that make it difficult to work in the crowd courier sector?
- Can you tell about the troublesome events and the most common problems that happen while doing your job? In such cases, who is responsible and how are the processes operated?
- Can you talk about the issues that affect safety of crowd couriers when working? In the event of a negative situation, who is responsible, how are the processes operated?
- Can you tell about the incidents you experienced that put the safety of crowd couriers

in danger? In the event of a negative situation, who is responsible, how are the processes operated?

- When the crowd courier has an accident while working in the vehicle while making a delivery, who is responsible and how is this process carried out?
- When the crowd courier has an accident while working outside the vehicle, who is responsible and how is this process carried out?
- When there is a confusion, damage, loss, theft or similar incident related to the package to be delivered, who is responsible, who covers the costs and according to what?
- If the crowd courier receives a traffic or parking ticket during work, who is responsible and who pays the costs?
- When there is an issue that the crowd courier experiences while working that reaches a legal dimension, who is responsible and how is the process carried out?
- Who is responsible for the fuel expenses during the work and who pays the costs?
- Who is responsible for the depreciation cost of increasing the mileage of the vehicle used by the crowd courier in delivery and who pays the costs?
- Who is responsible for the nutritional expenses of the crowd courier during work?
- To what extent is the personal information of crowd couriers shared with customers (receivers)? (Personal mobile phone number, name/surname, current location when making deliveries, ID photos and so on)
- How are delivery packages confirmed for the absence of dangerous or illegal substances and how is this information shared with crowd couriers?

About Performance Evaluation

23. Is there a performance follow-up in which the expectations from crowd couriers are measured and how are the results of the evaluation communicated with crowd couriers?

About Issues for Improvement

24. What do you think are the issues and conditions that are open to development and improvement in the crowd courier business?

- What would you like to see improved in working terms and conditions?
- What conditions shall be met to obtain a higher performance and satisfaction from the work of crowd couriers?

Appendix D – Complete List of Systematic Literature Review Coding with Literature References

ECONOMIC SUSTAINABILITY BENEFITS OF CROWD DELIVERY FOR COMPANIES		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Reduced costs	asset light infrastructure	Seghezzi et al., 2021, Pourrahmani and Jaller, 2021, Gläser, Jahnke and Strassheim, 2021, Castillo et al., 2021, Dupljanin et al., 2019, Huang and Ardiansyah, 2019, Castillo et al., 2018, Zehtabian, Larsen and Wøhlk, 2022, Ermagun and Stathopoulos, 2021, Voigt and Kuhn, 2021, Rechavi and Toch, 2020, Simoni et al., 2020, Le and Ukkusuri, 2019b, Buldeo Rai, Verlinde and Macharis, 2018, Buldeo Rai et al., 2017, Shen and Lin, 2020, Dayarian and Savelsbergh, 2020, Miller, Marco Nie and Stathopoulos, 2017, Zhou et al., 2022, Zhang et al., 2022, Choi, Bedogni and Levorato, 2022, Savelsbergh and Ulmer, 2022, Bin et al., 2021, Basik et al., 2021, Zhen et al., 2021, Martín-Santamaría et al., 2021, Li, Wang and Rezaei, 2020, Feng et al., 2021, Yi et al., 2020, Bin et al., 2020, Li et al., 2020, Li et al., 2019, Le et al., 2019, Akeb, Moncef and Durand, 2018, Punel, Ermagun and Stathopoulos, 2018, Ta, Esper and Hofer, 2018, Carbone, Rouquet and Roussat, 2017, Punel and Stathopoulos, 2017, Zhang et al., 2017, Chen et al., 2017, Kafle, Zou and Lin, 2017, Lee, Kang and Prabhu, 2016, Dai, Jia and Liu, 2020, Behrend et al., 2019, Allahviranloo and Baghestani, 2019, Wang et al., 2019, Alnaggar, Gzara and Bookbinder, 2021, Boysen, Emde and Schwerdfeger, 2022
	less capital investment	
	reduce fleet size	
	reduced delivery cost	
	reduced truck trips and miles traveled	
	reduced operational cost	
	transferring entire business risk to crowd	
	part-time rather than full time couriers	
	paying small compensations to couriers for deliveries	
	releases company from employer commitments and obligations	
	reduced fixed cost	
	reduced depreciation cost	
	reduced logistics infrastructure	
	reduced fleet costs	
	reduced fleet maintenance costs	
	reduced fuel costs	
	reduced drivers costs	

	reduced warehouse costs	
	reduced penalty for providing services outside of consumers' preferences	
	cost efficiency, cost-effective delivery	
Faster delivery	shorter delivery times	Nieto-Isaza, Fontaine and Minner, 2022, Alharbi, Cantarelli and Brint, 2022, Gläser, Jahnke and Strassheim, 2021, Zehtabian, Larsen and Wøhlk, 2022, Rechavi and Toch, 2020, Simoni et al., 2020, Le and Ukkusuri, 2019b, Shen and Lin, 2020, Dayarian and Savelsbergh, 2020, Miller, Marco Nie and Stathopoulos, 2017, Zhou et al., 2022, Basik et al., 2021, Alnaggar, Gzara and Bookbinder, 2021, Yi et al., 2020, Bin et al., 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Li et al., 2019, Zhang et al., 2017
	enables same day delivery	
	even 2 hour delivery	
Higher delivery efficiency	destination locating efficiency	Alharbi, Cantarelli and Brint, 2022, Gläser, Jahnke and Strassheim, 2021, Wang et al., 2019, Zehtabian, Larsen and Wøhlk, 2022, Yu, Jodiawan and Redi, 2022, Simoni et al., 2020, Zhang et al., 2022, Bin et al., 2021, Wang and Xie, 2021, Li, Wang and Rezaei, 2020, Bin et al., 2020, Li et al., 2019, Zhang et al., 2019, Akeb, Moncef and Durand, 2018, Carbone, Rouquet and Roussat, 2017, Kafle, Zou and Lin, 2017
	better routing	
	better route planning	
	enables traffic information	
	reduced delay	
	reduced repeat visit	
	efficient task assignment	
	improved supply-demand matching	
	improved distributon efficiency	
	reduced parcel turnaround	
	reduced delivery trips	

	reduced delivery failure rate	
	better operational efficiency	
	enables independent task assignment	
Improved flexibility	flexible work force	Seghezzi et al., 2021, Alharbi, Cantarelli and Brint, 2022, Huang and Ardiansyah, 2019, Wang et al., 2019, Rechavi and Toch, 2020, Simoni et al., 2020, Buldeo Rai et al., 2017, Shen and Lin, 2020, Savelsbergh and Ulmer, 2022, Wang and Xie, 2021, Zhen et al., 2021, Cieplińska and Szmelter-Jarosz, 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Punel and Stathopoulos, 2017, Chen et al., 2017, Feng et al., 2021, Gläser, Jahnke and Strassheim, 2021, Nieto-Isaza, Fontaine and Minner, 2022
	operational flexibity	
	flexibility to enable personalization, customization	
	delivery flexibity	
	24/7 operations availability	
	enables time precise delivery	
Improved customer service levels	higher quality of service	Gläser, Jahnke and Strassheim, 2021, Ermagun and Stathopoulos, 2021, Buldeo Rai, Verlinde and Macharis, 2018, Li et al., 2019, Akeb, Moncef and Durand, 2018, Ta, Esper and Hofer, 2018, Zhang et al., 2017
	ability to fit changing customer needs	
	increased customer satisfaction	
	higher repeat customers	
Transparency	enables tracking	Alharbi, Cantarelli and Brint, 2022, Gläser, Jahnke and Strassheim, 2021, Le et al., 2019,
	enables tracing	
	enables real-time communication	
Higher delivery capacity and accesibility	higher quantity of available carriers	Gläser, Jahnke and Strassheim, 2021, Wang et al., 2016, Rechavi and Toch, 2020, Simoni et al., 2020, Bin et al., 2021, Basik et al., 2021, Wang and Xie, 2021, Li, Wang and Rezaei, 2020, Bin et al., 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Boysen, Emde and Schwerdfeger, 2022, Behrend et al., 2019, Castillo et al., 2021
	higher loading capacity	
	better meet growing demand	
	minimize human resource shortages	
	maximizing resources utility	
	maximizing crowds utility	

	offer a variety of options and services at all times	
Improved reliability of services	offer feedback system	Zhang et al., 2019
	secure online payments	
	insurance	
	transaction security	
	reliable operational processes	
Increased customer base and access to new markets	enter new geographical markets	Gläser, Jahnke and Strassheim, 2021, Castillo et al., 2021, Buldeo Rai et al., 2017, Rześny-Cieplińska and Szmelter-Jarosz, 2019
	potential to reach a large area	
	enables meal delivery	
	enables delivery of a wide range of items	
	provides a marketplace for products from stores	
	opportunity to engage a wide range of users	
Provide competitive adventage	build up a customer network	Gläser, Jahnke and Strassheim, 2021, Wang et al., 2016, Dayarian and Savelsbergh, 2020
	allow retailers to have more delivery options	
	allow expansion of service offerings	
Bringing profit to platform providers	greater revenue creation	Buldeo Rai, Verlinde and Macharis, 2018, Buldeo Rai, Verlinde and Macharis, 2021, Zhang et al., 2022, Bin et al., 2021, Wang and Xie, 2021, Le et al., 2021, Cieplińska and Szmelter-Jarosz, 2020, Huang et al., 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Zhang et al., 2017, Lee, Kang and Prabhu, 2016
	higher profitability	
ECONOMIC SUSTAINABILITY BENEFITS OF CROWD DELIVERY FOR CROWD COURIERS		
CRITERIA	**DESCRIPTION**	**SOURCE**

Additional income source	reduces income instabilty	Voigt and Kuhn, 2021, Rechavi and Toch, 2020, Buldeo Rai et al., 2017, Du et al., 2019, Li et al., 2019, Carbone, Rouquet and Roussat, 2017, Torres, Gendreau and Rei, 2022
	balance fluctuations in their income	
	undertaking tasks in addition to their primary job	
Income source	revenue creation	Punel and Stathopoulos, 2017, Binetti et al., 2019, Seghezzi et al., 2021, Frehe, Mehmann and Teuteberg, 2017, Upadhyay, Tewari and Tiwari, 2021, Alharbi, Cantarelli and Brint, 2022, Fessler et al., 2022, Yu, Jodiawan and Redi, 2022, Wang and Xie, 2021b, Buldeo Rai, Verlinde and Macharis, 2018, Cheng et al., 2022, Buldeo Rai, Verlinde and Macharis, 2021, Arditi and Toch, 2022, He and Csiszár, 2021, Le et al., 2019, Le et al., 2021, Li, Wang and Rezaei, 2020, Yi et al., 2020, Huang et al., 2020, Li et al., 2019, Zhang et al., 2019, Boysen, Emde and Schwerdfeger, 2022, Behrend et al., 2019, Allahviranloo and Baghestani, 2019
	adding income to their commute or drive	
	recieving benefits, reward, compensation, money, bonus points	
	riding fare can be reduced	
	informative technology help crowd save costs	
Flexible working conditions	adaptable work to their lifestyle	Ermagun and Stathopoulos, 2021, Buldeo Rai et al., 2017, Miller, Marco Nie and Stathopoulos, 2017, Lee, Chang and Cho, 2022, Le et al., 2019, Carbone, Rouquet and Roussat, 2017
	ability to work at anytime and anyplace	
Increased employment opportunity	new employment generation	Nieto-Isaza, Fontaine and Minner, 2022, Ermagun and Stathopoulos, 2021, Shen and Lin, 2020, Zhang et al., 2022, Ermagun, Shamshiripour and Stathopoulos, 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Le and Ukkusuri, 2019, Carbone, Rouquet and Roussat, 2017
	new employment possibilites	
	new job options and opportunity	
	lower entry barriers for workers	
Labor and workload friendly	reduced time-intensive labor	Chen, Wang and Zhang, 2020, Alharbi, Cantarelli and Brint, 2022
	reduced heavy workloads	
	drop-off flexibility prevents unattended home	

	deliveries	
ECONOMIC SUSTAINABILITY BENEFITS OF CROWD DELIVERY FOR CUSTOMERS		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Accessibility	can source or transport items not available locally or through standard delivery services	Ermagun, Punel and Stathopoulos, 2020
Competitive adventage and Fairness	enhance traffic performance	Le et al., 2019, Lee, Chang and Cho, 2022, Le and Ukkusuri, 2019, Ermagun and Stathopoulos, 2021, Gläser, Jahnke and Strassheim, 2021, Le et al., 2021, Chen, Wang and Zhang, 2020, Pourrahmani and Jaller, 2021, Voigt and Kuhn, 2021, Buldeo Rai, Verlinde and Macharis, 2018
	enable smaller merchants to broaden their customer base and provide new services	
	provides promise for the restaurant industry's growth and development	
	improved delivery services draw in more clients	
	ability to expand service area	
	can provide the option of same-day delivery even if the physical store does not do it	
	enables brick-and-mortar only merchants to become internet distribution available	
	can increase a company's competitiveness	
	offer fair pricing and access to regardless of the size and location of the business	
Convenience	ability to offer easy last mile services to customers	Buldeo Rai, Verlinde and Macharis, 2021, Ermagun, Punel and Stathopoulos, 2020
	offering clients' convenience as it provides door-to-door delivery with variable scheduling	

Faster delivery	enables the ability to offer fast delivery	Bin et al., 2020, Pourrahmani and Jaller, 2021, Gläser, Jahnke and Strassheim, 2021, Lee, Chang and Cho, 2022, Le et al., 2021, Alnaggar, Gzara and Bookbinder, 2021, Ermagun, Punel and Stathopoulos, 2020, Du et al., 2019
	enables the ability to offer same day delivery	
Flexibility	ability to provide personal last mile services	Buldeo Rai, Verlinde and Macharis, 2021, Ermagun, Li et al., 2020
	ability to provide flexible last mile services	
	flexible working hours are ideal for food deliveries which have peaks and valleys	
Improved delivery efficiency	increase the delivery efficiency	Liu et al., 2019, Bin et al., 2020, Sampaio et al., 2020
	improved delivery rate	
	improved delivery service	
Increase customer satisfaction	provides an increase in customer satisfaction	Le et al., 2019, Ermagun and Stathopoulos, 2021
Increasing delivery service	can provide more delivery options to customers	Le and Ukkusuri, 2019
Reduced delivery price	provides affordable delivery option as it is an asset-light business model	Ermagun, Punel and Stathopoulos, 2020, Buldeo Rai, Verlinde and Macharis, 2018, Le and Ukkusuri, 2019, Le et al., 2021, Seghezzi et al., 2021, Pourrahmani and Jaller, 2021, Gläser, Jahnke and Strassheim, 2021, Ermagun and Stathopoulos, 2021, Alnaggar, Gzara and Bookbinder, 2021, Bin et al., 2020, Du et al., 2019, Liu et al., 2019
	reduces transport costs for last mile delivery	
	reduces transport costs for same day delivery	
	cost savings enable to offer free delivery to the customers	
	possibility for neighborhood stores to establish their own delivery network	
	reduce the cost of hiring delivery personnel	

	provides cost effective delivery	
Service level improvement	crowd delivery supports high consumer service levels	Sampaio et al., 2020
Faster delivery	enables shorter delivery times	Shen and Lin, 2020, Choi, Bedogni and Levorato, 2022, Ermagun, Shamshiripour and Stathopoulos, 2020, Yi et al., 2020
	enables same day deliveries	
Flexibility	offers shipping flexibility	Shen and Lin, 2020, Ermagun, Shamshiripour and Stathopoulos, 2020
	enables reception for customers	
Reduced price delivery / Affordability:	offers lowered delivery prices	Frehe, Mehmann and Teuteberg, 2017, Ermagun, Shamshiripour and Stathopoulos, 2020, Yi et al., 2020
Service level improvement	getting better services	Zhang et al., 2022, Huang et al., 2020
Accessibility	gain access to new products that are not available in their area	Buldeo Rai et al., 2017, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Ermagun and Stathopoulos, 2021, Ermagun, Punel and Stathopoulos, 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Le and Ukkusuri, 2019, Le et al., 2019, Paloheimo, Lettenmeier and Waris, 2016, Rześny-Cieplińska and Szmelter-Jarosz, 2019,
	opportunity to access a wider variety of products	
	reach a more extensive range of products	
	capacity to offer a variety of options and providers whenever and wherever they are needed (regional, national, international scales).	
	easy and improved service accessibility	
Convenience	make use of convenient last mile delivery as they can choose the time and location of their deliveries and manage the pick-up and drop-off of their packages	Buldeo Rai, Verlinde and Macharis, 2021, Buldeo Rai et al., 2017, Punel, Ermagun and Stathopoulos, 2019, Punel, Ermagun and Stathopoulos, 2018, Ermagun, Punel and Stathopoulos, 2020

	with easy last mile services	
	provides convenience as it allows door-to-door delivery with variable scheduling	
Faster receiving	recruitment of vehicles is initiated immediately after the package delivery request is created and this fluidity reduces waiting time	Chen, Wang and Zhang, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Le and Ukkusuri, 2019, Seghezzi et al., 2021, Alharbi, Cantarelli and Brint, 2022, Zehtabian, Larsen and Wøhlk, 2022, Ermagun and Stathopoulos, 2021, Buldeo Rai et al., 2017, Behrend and Meisel, 2018, Arditi and Toch, 2022, Le et al., 2021, Ermagun, Punel and Stathopoulos, 2020, Bin et al., 2020, Le et al., 2019, Carbone, Rouquet and Roussat, 2017
	shorter delivery times and faster receiving (compared to using courier companies).	
	availability of same day delivery	
Flexibility	more personalized delivery services	Gläser, Jahnke and Strassheim, 2021, Ermagun and Stathopoulos, 2021, Buldeo Rai et al., 2017, Buldeo Rai, Verlinde and Macharis, 2021, Bin et al., 2020, Le et al., 2019, Seghezzi et al., 2021, Alharbi, Cantarelli and Brint, 2022, Buldeo Rai et al., 2017, Chen, Wang and Zhang, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Le and Ukkusuri, 2019, Punel, Ermagun and Stathopoulos, 2019, Le et al., 2019, Punel, Ermagun and Stathopoulos, 2018, Punel and Stathopoulos, 2017
	provides personal last mile services	
	personalization through communicating with the crowd courier to communicate desired qualities of the products (i.e. ripeness of bananas' at grocery shopping).	
	provides increased flexibility with high degree of operational flexibility	
	flexible last mile services	
	provides flexibility as it enables personalization, customization control over pickup and delivery conditions	

	drop-off flexibility solves unattended home delivery issue for customers	
	deliveries are flexible to be defined by customers requests as package deliveries are processed, managed, and distributed individually	
	flexible to offer a variety of options at any time, anywhere, and along any route required	
Increasing delivery service	profit from greater option of deliveries and innovative delivery techniques	Voigt and Kuhn, 2021, Ermagun and Stathopoulos, 2021
Reduced price delivery/Affordability	provides affordable prices as it is a an asset-light business model (cost reductions are passed on to the customer).	Ermagun, Punel and Stathopoulos, 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Buldeo Rai et al., 2017, Zehtabian, Larsen and Wøhlk, 2022, Ermagun and Stathopoulos, 2021, Le et al., 2019, Punel, Ermagun and Stathopoulos, 2018, Carbone, Rouquet and Roussat, 2017, Seghezzi et al., 2021, Alharbi, Cantarelli and Brint, 2022, Behrend and Meisel, 2018, Arditi and Toch, 2022, He and Csiszár, 2021, Le et al., 2021, Bin et al., 2020, Le and Ukkusuri, 2019, Punel, Ermagun and Stathopoulos, 2019, Li et al., 2019, Punel and Stathopoulos, 2017, Behrend et al., 2019
	better priced (compared to using courier company).	
	lower cost for sending and receiving packages	
	availability of affordable priced same day deliveries	
	opportunity for getting cost-efficient delivery service	
Improved customer service levels	getting better customer service with improved service level performances	Seghezzi et al., 2021
Transparency	transparent delivery processes	Carbone, Rouquet and Roussat, 2017, Buldeo Rai et al., 2017, Punel and Stathopoulos, 2017
	traceable delivery in real-time	
	enables tracking of deliveries	
	uses innovative communication techniques to connect	

	with the crowd courier via smartphones	
ECONOMIC SUSTAINABILITY RISKS OF CROWD DELIVERY FOR COMPANIES		
CRITERIA	**DESCRIPTION**	**REFERENCE**
Balancing demand and supply sides challanges	challenging to build a critical mass of crowd couriers and customers	Basik et al., 2021, Dayarian and Savelsbergh, 2020, Castillo et al., 2022, Ermagun, Shamshiripour and Stathopoulos, 2020, Wang and Xie, 2021, Castillo et al., 2018, Basik et al., 2021, Wang and Xie, 2021b, Punel and Stathopoulos, 2017, Guo et al., 2019, Zehtabian, Larsen and Wøhlk, 2022, Wang and Xie, 2021, Gläser, Jahnke and Strassheim, 2021, Nieto-Isaza, Fontaine and Minner, 2022, Sampaio et al., 2020, Savelsbergh and Ulmer, 2022, Le and Ukkusuri, 2019b
	a powerful network of customers are necessary to engage a powerful network of crowd couriers and vice versa (chicken and egg problem).	
	to provide sufficient workforce to accommodate demand is chalenging	
	challenging to balance demand and supply sides of the CD platform	
	challenging to coordinate supply with demand to an equilibrium state	
	demand (customer). is stochastic (dynamic/unknown/random).	
	supply (crowd). is stochastic (dynamic/unknown/random).	
	orders locations are random, crowd couriers are dynamic and random, therefore delivery capacity is random	

	delivery locations are random, crowd couriers are dynamic and random, therefore delivery capacity is random	
	delivery requests are submitted dynamically, delivery requests are unknown a priori so pick-up and delivery times are challenging to estimate	
	hard to balance supply and demand which brings operational risk as crowd couriers are independent to accept or reject deliveries	
	hard to balance supply and demand which brings operational risk as crowd couriers working schedule are independent	
	difficult to coordinate uncertain supply to adequately provide services for the stochastic demand, brings suppy-demand matching, operational and managemental problems	
	since crowd is not employed by contract, delivery capacity becomes insecure and company has limited control managing deliveries	
	crowd delivery succes is doubtful for economies of scale	
Encourage initial and continued	crowd are free lancers with diverse needs, how to meet their diverse needs, guarantee the amount of	Yi et al., 2020, Zhang et al., 2022, Gläser, Jahnke and Strassheim, 2021, Basik et al., 2021, Wang and Xie, 2021b, Voigt and Kuhn, 2021, Huang et al., 2020,

participation of crowd challanges	necessary supply, improve their job satisfaction and guide them to participate in crowd delivery services is problematic	Pourrahmani and Jaller, 2021, Cheng et al., 2022, Dayarian and Savelsbergh, 2020, Sampaio et al., 2020, Miller, Marco Nie and Stathopoulos, 2017
	challenging to design appropriate compensation scheme to incentivize and engage a large enough crowd	
	crowd are floating resources, they compare service compensation and order amounts of crowd initiatives while choosing between CD companies	
	compensation scheme must be designed to attract enough crowd couriers but at the same time be cost-effective	
	critical to ensure fairness for high worker participation (fair pricing, distributional fairness, matching crowd with tasks that are proportional to their spatio-temporal matching qualities, availabilities for the tasks).	
	challenging to incentivize, engage and maintain a large enough crowd to support faster and cheaper delivery service	
	crowd logistics is still in the exploration stage, legal challenges, management and technical challanges may discourage continued crowd participation	

	time, energy and equipment costs incurred by the crowd workers may discourage continued participation (e.i. long distance detours decrease income of crowd courier and reduce engagement).	
Managing complex and unknown characteristics of the crowd challaneges	individuals making up the crowds are previously unknown and have a complex composition	Li, Wang and Rezaei, 2020, Torres, Gendreau and Rei, 2022, Behrend et al., 2019
	challanging to manage diverse and unknown preferences and characteristics of a large group of individuals	
	unknown/anonymity of crowd couriers, brings risk to making competence analysis of crowd couriers	
	crowd couriers have different models of vehicles of heterogeneous sizes, which makes delivery capacity variety and obscurity, challanging to manage a priori	
Ensuring quality of service and efficiency challanges	subcontracting individuals with low entrance barriers and lack of job security, crowd couriers are floating resources, which causes them to be less dedicated and unmotivated regarding their work performance	Boysen, Emde and Schwerdfeger, 2022, Lee, Chang and Cho, 2022, Li, Wang and Rezaei, 2020, Song, Hu and Xue, 2022, Cheng et al., 2022, Le et al., 2019, Cieplińska and Szmelter-Jarosz, 2020, Dayarian and Savelsbergh, 2020, Voigt and Kuhn, 2021, Yildiz and Savelsbergh, 2019, Buldeo Rai et al., 2017, He and Csiszár, 2021, Szmelter-Jarosz and Rześny-Cieplińska, 2020
	low entry barriers are used to draw in people to sign up, however doing so puts the platform's reputation at risk and reduces service quality and customer satisfaction	
	challenging to ensure quality of service with a large	

	and complex composition of labor-intensive service network of crowd couriers	
	customers want to know that their packages are secure and insured, and the platform's primary responsibility is to fulfill these needs. Insurance is the main worry of customers, particularly for expensive shipments. The shipping company loses competitive edge by including insurance expenses in delivery pricing.	
	high effort put forth by crowd couriers risk assuring quality of the crowd delivery service	
	it is difficult to maintain a functional relationship with crowd couriers, and it is likely that some crowd couriers may sabotage delivery assignments, which results in major uncertainty for the logistics company	
	challanging to encourage and include sufficient number of crowd couriers that can contribute to the system	
	crowd couriers should receive adequate training to cut down on customer handover times	
	potential employees are hired in real-time without an interview or recruitment procedure, they just register on a digital platform which brings significant risks associated with crowd couriers (undefined,	

	unqualified, inexperienced, or low commited crowd of individuals).	
	delivery task's voluntary and flexible undertaking by the crowd presents difficulties in maintaining and ensuring specific degrees of service quality	
	unknown crowd members are a significant source of stress regarding ensuring quality of service (quality and service are harder to assess and cannot be assured even though the platform registers and tracks the crowd).	
	efficiency of deliveries may be impacted by ethical and cultural barriers (interaction between opposite genders that may embarress both sides in some cultures).	
Technology accessibility and complexity related challanges	online allocation is challenging because the platform doesn't have advance knowledge of all assignments and crowd availabilities	Basik et al., 2021, Lee, Chang and Cho, 2022, Pourrahmani and Jaller, 2021
	virtual environment risks associated with planning/control, team members, work needs, and technological complexity	
	digital workplace present hazards that are associated to unskilled and undefined workers, which can lead to	

	a number of significant risks	
	technical difficulties lead to increased task requirements and technological complexity	
	workers are isolated from and in direct competition with one another in a virtual environment, and it increases workers' tendency to feel distant or detached from their jobs, which results in poor job involvement and lack of commitment	
	only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	
Voluntary, flexible and uncertain supply related challanges	couriers are not employed by the platform, the platform may be unable to control the behavior of occasional couriers which risks steady operations	Boysen, Emde and Schwerdfeger, 2022, Buldeo Rai et al., 2017, Castillo et al., 2018, Chen et al., 2017, Cieplińska and Szmelter-Jarosz, 2020, Ermagun and Stathopoulos, 2018, Horner, Pazour and Mitchell, 2021, Li, Wang and Rezaei, 2020, Nieto-Isaza, Fontaine and Minner, 2022, Savelsbergh and Ulmer, 2022, Song, Hu and Xue, 2022, Torres, Gendreau and Rei, 2022, Voigt and Kuhn, 2021, Wang and Xie, 2021, Yildiz and Savelsbergh, 2019, Zehtabian, Larsen and Wøhlk, 2022
	voluntary character of crowd couriers is problematic as they self-select the services they wish to fulfil	
	crowd can accept or reject delivery tasks, such excessive forms of crowd courier flexibility is unfavourable for the crowd labourer	
	crowd can deviate from route guidance or repositioning suggestions and such excessive forms of crowd courier flexibility is unfavourable for the crowd labourer	

	task selection behaviour is unpredictable by the platform and platform do not have perfect knowledge of drivers decisions	
	performance is tied to the crowd, their time flexibility, and willingness to participate in the system	
	crowd destinations can change from day to day	
	crowd participation change from day to day	
	availability of occasional couriers is affected by a variety of factors, such as prevailing weather conditions	
	network structure (crowd). being dynamic leads to operational instability	
	Uncertain fleet makes vehicle routing problem hard	
ECONOMIC SUSTAINABILITY RISKS OF CROWD DELIVERY FOR CROWD COURIERS		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Cost concerns	platforms do not reimburse for fuel	Pourrahmani and Jaller, 2021, Devari, Nikolaev and He, 2017
	platforms do not reimburse for parking costs	
	platforms do not reimburse for parking tickets	
	platforms do not reimburse for toll fares	
	crowd courier company's transferred costs are borne by the crowd couriers in crowd deliveries	
	income may reduce for difficulties in finding parking	

	spaces	
	income may reduce for difficulties in long reception waiting times for deliveries	
	some platforms encourage the purchase of personal insurance by crowd couriers	
	some platforms offer commercial auto-insurance for crowd couriers to protect them from customers' rude or threatening behaviour	
Income security concerns	company do not offer basic labour protections such as minimum wage	Pourrahmani and Jaller, 2021, Zhang et al., 2022
	crowd couriers do not have a base salary, and the number of orders they successfully execute determines how much money they make	
	company do not offer basic labour protections such as overtime payments (in congested urban locations, finding parking adds to the delivery times; however payment for delivery task does not increase to account for these unexpectedly long additions).	
	company do not offer basic labour protections such as unemployment benefits	
	tips should be added to a courier's earnings; however some platforms use tips to partially cover the	

	customers' base payment	
Economic liability concerns	companies take no responsibility for crowd couriers involved in accidents	Pourrahmani and Jaller, 2021
	companies take no responsibility for stolen, lost, or damaged packages	
	crowd couriers' credit card being put on hold until the delivery is fulfilled to guarantee the delivery of valuable items	
Efficiency related concerns	income may reduce for returned deliveries due to receiver absences	Pourrahmani and Jaller, 2021, Cheng et al., 2022, Lee, Chang and Cho, 2022
	income may reduce for receivers privacy concerns over sharing actual addresses with shippers	
	long-distance detours to deliver packages decrease crowds' income to effort ratio	
	avoidance of direct communication has negative impact on work performance as it may result in misinformation and wrong product/service representation (no contact food delivery service).	
Cultural and demographic barriers	income may reduce due to decreasing safety of transactions and parcel delivery impacted by cultural barriers (interaction between opposite genders that may embarress both sides in some cultures).	Alharbi, Cantarelli and Brint, 2022, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Ta, Esper and Hofer, 2018, Le et al., 2019

	income may reduce due to customers' attitudes towards crowd couriers impacted by ethnicity (disclosing crowd's identity increase customers' trust, satisfaction, and repurchase intentions particularly when customers perceive the crowd to be ethnically similar to them).	
	digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers).	
Price exploitation concerns	fixed delivery task pricing is not always fair enough to satisfy crowd couriers (rather crowd couriers perceive cost also by delivery time, distance, size, weight).	Pourrahmani and Jaller, 2021, Xiao et al., 2021, Yi et al., 2020, Voigt and Kuhn, 2021, Buldeo Rai, Verlinde and Macharis, 2018, Rechavi and Toch, 2020
	price-only auction procedures used by platforms may not accurately reflect the value of the delivery for the requester and set the wrong compensation rates for crowd couriers	
	absence of employment contract, typical for the crowd logistics	
	customers strong bargaining position makes more room for price exploitation and complicates fair pay	
	possible exploitation of crowd couriers as they have	

	tendency to underestimate the value of their time	
	possible exploitation of crowd couriers as they have tendency to underestimate the vehicle operating costs	
	absence of an employment contract crowd's fair pay	
	low payment	
Job instability concerns	crowd couriers have a hard time grabbing transport orders due to low frequency of freight transport demands	Yi et al., 2020, Le et al., 2019
	although having a flexible schedule can be an advantage, crowd couriers may lack job stability	
ECONOMIC SUSTAINABILITY RISKS OF CROWD DELIVERY FOR CUSTOMERS		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Service quality ambiguity	senders may question whether the packages will arrive on time	Le et al., 2019, Rześny-Cieplińska and Szmelter-Jarosz, 2019
	tracking and transparency are positive sides but can not guarantee quality and service to customers	
Cultural, ethnical and demographic barriers	safety of transactions and parcel delivery may be impacted by cultural barriers (interaction between opposite genders that may embarress both sides in some cultures).	Rześny-Cieplińska and Szmelter-Jarosz, 2019, Le et al., 2019
	digital platform acts as a barrier for demographic segments without access to connected device	

	technology or a transaction account (by smartphones or computers).	
Cultural, ethnical and demographic barriers	customers' attitudes towards the retailers may be impacted by company (on crowd delivery platforms, revealing the identity of the crowd couriers may enhance trust, contentment, and repurchase intentions—but only when customers believe the drivers to be similar to them, particularly in terms of ethnicity.).	Ta, Esper and Hofer, 2018
Loss of control	crowd delivery service providers act as new intermediary between consumers and retailers, so retailers using crowd delivery service platforms give up some bargaining power	Carbone, Rouquet and Roussat, 2017
SOCIAL SUSTAINABILITY BENEFITS OF CROWD DELIVERY FOR COMPANIES		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Builds trust	platforms' secure online payment systems	Pourrahmani and Jaller, 2021, Cieplińska and Szmelter-Jarosz, 2020, Alharbi, Cantarelli and Brint, 2022
	enables private interaction and direct communication (between couriers and requesters during delivery process).	
	ordering safety	
Image improving	through offering environmental and social gains	Buldeo Rai et al., 2017
Simplicity for crowd	no contractual details	Cieplińska and Szmelter-Jarosz, 2020

and customer		
Supporting community	generates a more community-oriented relationship between the company and its customers	Alharbi, Cantarelli and Brint, 2022, Le et al., 2019
Tracking and transparency	platform registers and tracks the crowd	Szmelter-Jarosz and Rześny-Cieplińska, 2020
Operates as a mediator between networks	connecting businesses, crowd and consumers	Rześny-Cieplińska and Szmelter-Jarosz, 2019
SOCIAL SUSTAINABILITY BENEFITS OF CROWD DELIVERY FOR CROWD COURIERS		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Altrustic experience	travelling to make someone happy	Carbone, Rouquet and Roussat, 2017
Empowering communities	fostering social connections	Nieto-Isaza, Fontaine and Minner, 2022, Alharbi, Cantarelli and Brint, 2022, Buldeo Rai et al., 2017, Le et al., 2019, Akeb, Moncef and Durand, 2018
	having private interactions	
	having personal contact with neighbours	
	creates neighbourliness	
Experiencing enjoyment of work	participating in the system	Huang et al., 2020
Flexibility of time	flexible working opportunities	Seghezzi et al., 2021, Upadhyay, Tewari and Tiwari, 2021, Wang and Xie, 2021b
	flexible work time schedule	
Gives sense of reducing their own travel's impact on the environment	providing health benefit to the society (related to green modal choices).	Le et al., 2019, Behrend et al., 2019

Gives sense of serving	serving their community	Behrend et al., 2019
Voluntary character	choose the services they want to offer, for themselves the services they want to offer	Szmelter-Jarosz and Rześny-Cieplińska, 2020
SOCIAL SUSTAINABILITY BENEFITS OF CROWD DELIVERY FOR CUSTOMERS		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Connecting	Crowd delivery company operates as a mediator and connects individual providers (crowd). and consumers (customers).	Rześny-Cieplińska and Szmelter-Jarosz, 2019
Convenience	decreased privacy concerns when uses customers' social network for deliveries	Devari, Nikolaev and He, 2017, Wang et al., 2016, Akeb, Moncef and Durand, 2018,
	enables one to one communication between customers and crowd	
	provides customers convenience by adding a layer between customers and crowd	
Trust	provides trust by ordering safety	Rześny-Cieplińska and Szmelter-Jarosz, 2019
Simplicity	eliminates language barrier	Alharbi, Cantarelli and Brint, 2022, Wang et al., 2016, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Akeb, Moncef and Durand, 2018
	provides greater simplicity for customers when compared to traditional delivery	
	provies ordering simplicity by eliminating contractual details for customers	
Empower communities	promotes broader community cohesion by fostering social connections	Nieto-Isaza, Fontaine and Minner, 2022, Alharbi, Cantarelli and Brint, 2022, Wang et al., 2016, Buldeo Rai et al., 2017, Le et al., 2019, Punel, Ermagun and

	empower communities/neighbourhoods by strengthening their social networks through supporting their private interactions	Stathopoulos, 2018
	Supports greater sense of community	
	each individual participates in social change as it improves everyone's life	
Transparency	enables more transparency when compared to traditional delivery by real-time tracking and location sharing	Alharbi, Cantarelli and Brint, 2022, Rześny-Cieplińska and Szmelter-Jarosz, 2019
	by tracking and transparency, crowd is registered and tracked by the platform	
Voluntary character	customers self-select the logistics services they wish to use	Szmelter-Jarosz and Rześny-Cieplińska, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019
SOCIAL SUSTAINABILITY RISKS OF CROWD DELIVERY FOR COMPANIES		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Fostering acceptability	challenge of fostering acceptability of new delivery models	Punel and Stathopoulos, 2017, Upadhyay, Tewari and Tiwari, 2021
	limited technology acceptability of sharing economy users can be a barrier	
Liability concerns	working with non-professional couriers can lead to issues of liability	Ermagun, Shamshiripour and Stathopoulos, 2020, Punel and Stathopoulos, 2017, Gläser, Jahnke and Strassheim, 2021
	clarification of liabilities before crowd courier starts to	

	work is must, who is liable if the parcel is damaged by the crowd courier	
	clarification of liabilities before crowd courier starts to work is must, who is liable if something happens to the crowd courier during delivery	
Privacy and confidentiality concerns	non-employment of crowd workers risks consumer information leakage	Bin et al., 2021, Buldeo Rai et al., 2017, Wang et al., 2016
	unknown crowd identity represents a substantial source of stress, for privacy concerns	
	data privacy and confidentiality poses risks	
Reliability concerns	reliability of company being tied to the crowd is a source of risk (their time flexibility, and willingness to participate in the system).	Ermagun and Stathopoulos, 2018
Reputation concerns	working with non-professional couriers can lead to issues of reputation	Punel and Stathopoulos, 2017
Security concerns	unknown crowd identity represents a substantial source of stress regarding vulnerability to criminal activity	Buldeo Rai et al., 2017, Ermagun, Shamshiripour and Stathopoulos, 2020
	unknown crowd identity represents a substantial source of stress regarding vulnerability to security obstacles	
Trust concerns	trust issues between the enterprise and crowd workers	Bin et al., 2021, Carbone, Rouquet and Roussat, 2017, Ermagun, Shamshiripour

	(affecting synergy efficiency, service quality, and operational performance).	and Stathopoulos, 2020, Huang et al., 2020, Punel and Stathopoulos, 2017, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Upadhyay, Tewari and Tiwari, 2021, Voigt and Kuhn, 2021
	lack trust from consumers issue for companies relying on individuals who are self-assessed (related to non-professionalism).	
	lack trust from consumers issue for companies relying on individuals who are amateur logistics skills are not certified (related to non-professionalism).	
	trust issues between crowd couriers and company emerging from risks and safety issues caused by delays in delivery	
	trust issues between crowd couriers and company emerging from risks and safety issues caused by loss or damage to goods	
	trust issues between crowd couriers and company emerging from risks and safety issues caused by traffic accidents	
	providing simplicity and trust for customers seeking ordering convenience and safety	
	trust-building, between the participants is a concern	
	consumers' lack of trust in sharing economy can be a barrier	
Legal concerns	risk of relying on a non-professional part-time	Miller, Marco Nie and Stathopoulos, 2017, Ermagun, Shamshiripour and

	delivery force	Stathopoulos, 2020
	legal obstacles related to non-professional delivery force	
Safety concerns	non-employment and unknown identity of crowd couriers represents risk of theft, loss, mishandled or damaged parcels	Bin et al., 2021, Buldeo Rai et al., 2017, Ermagun, Shamshiripour and Stathopoulos, 2020, Miller, Marco Nie and Stathopoulos, 2017
	safety concerns regarding relying on a non-professional part-time delivery force	
SOCIAL SUSTAINABILITY RISKS OF CROWD DELIVERY FOR CROWD COURIERS		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Cultural concerns	due to cultural issues interaction between opposite genders may embarress crowd couriers	Alharbi, Cantarelli and Brint, 2022
Health concerns	cyclists and pedestrians are vulnerable to traffic accidents and road injuries	Pourrahmani and Jaller, 2021
	may encourage risky driving practices because the amount of money earned depends on how many tasks are completed in a certain amount of time	
	physically demanding because crowd couriers must be strong to lift heavy items	
	physically demanding beacuse crowd couriers have to be fast to make pick-ups/drop-offs on time	

Privacy issues	crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed).	Wang et al., 2019
Psychological concerns	highly stressful type of occupation	Rechavi and Toch, 2020, Lee, Chang and Cho, 2022
	virtual environment risks feeling no commitment and detachment to work (they are self-employed, they do not want to be identified by their company name, don't feel any sort of commitment to them, no one knows exactly who I am).	
	crowd couriers experience frustration and emotional stress stemming from complex technology (food delivery). (crowd couriers have to manage increased task requirements (e.g. notifying customers of their arrival in real-time and managing proof of delivery digitally using technology).).	
Technology complexity concerns	crowd couriers perceive virtual environment job to be far more complex than they expected (crowd couriers have to manage increased task requirements (e.g. notifying customers of their arrival in real-time and managing proof of delivery digitally	Lee, Chang and Cho, 2022

	using technology).).	
	technology-related complex payment systems	
	complexities stemming from technology updates/downtime	
Trust, safety, security concerns	trust concerns related to receiver/sender dangerous behavior	Pourrahmani and Jaller, 2021, Alharbi, Cantarelli and Brint, 2022, Wang et al., 2016, Le et al., 2019
	trust concerns related to carrying hazardous, dangerous or illegal items	
	trust concerns about online payment	
	Trust, safety, and security concerns regarding work	
Work-life balance concerns	absence of an employment contract complicates crowd's working conditions and work-life balance	Buldeo Rai, Verlinde and Macharis, 2018, Yi et al., 2020
	customers have strong bargaining position which complicates crowd's working conditions and work-life balance	
Uncertainity concerns	Uncertainties among the crowd couriers regarding the absence of punishment guidelines to be acknowledged while accepting delivery assignments	Wang et al., 2016, Fessler et al., 2022, Le et al., 2019
	Uncertainties among the crowd couriers regarding the absence of requirements to be acknowledged while	

	accepting delivery assignments	
	crowd delivery business model lacks regulations about workers' rights (as part of sharing/gig economy).	
	a barrier to employing crowd delivery is legal considerations, for instance, requiring individuals to obtain delivery licenses	
	legal problem with across the country deliveries (the contents of the item may be allowed in the state from where it was sent, but forbidden in the state to which it is being delivered).	
SOCIAL SUSTAINABILITY RISKS OF CROWD DELIVERY FOR CUSTOMERS		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Accountability concerns	accountability of services is a concern	Buldeo Rai, Verlinde and Macharis, 2021
Cultural concerns	interaction between opposite genders may embarress consumer	Alharbi, Cantarelli and Brint, 2022
Liability concerns	liability regarding services is a concern	Punel, Ermagun and Stathopoulos, 2019
Privacy concerns	concerns about sharing their personal information (address, credit card information with strangers).	Pourrahmani and Jaller, 2021, Alharbi, Cantarelli and Brint, 2022, Buldeo Rai, Verlinde and Macharis, 2021, Punel, Ermagun and Stathopoulos, 2019, Le et al., 2019, Punel, Ermagun and Stathopoulos, 2018, Paloheimo, Lettenmeier and Waris, 2016
	crowd courier's knowing final destination raises privacy concerns (pricing based on detour distance	

	requirement).	
	concerns about sharing their personal information, home address, and purchasing habits	
Safety concerns	concerns regarding probabilities of theft, loss and damages to packages	Wang et al., 2019, Buldeo Rai, Verlinde and Macharis, 2021, Le and Ukkusuri, 2019, Le et al., 2019, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Punel, Ermagun and Stathopoulos, 2018, Szmelter-Jarosz and Rześny-Cieplińska, 2020
	security of goods is a concern as well as the procedure in case of damage	
Security concerns	security of consumers is a risk	Wang et al., 2019, Buldeo Rai, Verlinde and Macharis, 2021, Le and Ukkusuri, 2019, Le et al., 2019
	consumers have security concerns	
	safety of users receiving goods may not be guaranteed	
	concerns about sharing their personal information, home address, and purchasing habits	
Reliability concerns	reliability is an issue for consumers	Buldeo Rai, Verlinde and Macharis, 2021, Punel, Ermagun and Stathopoulos, 2019
	reliability issues	
	lack of trust between senders and couriers, as couriers are typically occasional drivers	
Service reliability concerns	concern that an anonymous crowd cannot provide a reliable service	Behrend et al., 2019
Trust concerns	senders have concerns about leaving their packages with crowd couriers who are not necessarily employees of a traditional courier company	Pourrahmani and Jaller, 2021, Alharbi, Cantarelli and Brint, 2022, Buldeo Rai, Verlinde and Macharis, 2021, Punel, Ermagun and Stathopoulos, 2019, Le et al., 2019
	undefined character of the crowd, is a substantial	

	source of stress , important for individuals to know to or from whom they deliver or receive their orders	
	consumers have concerns about online payment	
ENVIRONMENTAL SUSTAINABILITY BENEFITS OF CROWD DELIVERY FOR THE SOCIETY		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Betterment of air quality	using green modal choices lower air pollutants	Chen, Wang and Zhang, 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Cieplińska and Szmelter-Jarosz, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019
	involving regular road users in the delivery process	
Decreasing total emissions e.g. greenhouse, carbon, CO2, nitrogen oxides, PM2.5, and PM10	leveraging planned trips result in fewer vehicles on the and road reduce traffic flows	Seghezzi et al., 2021, Guo et al., 2019, Nieto-Isaza, Fontaine and Minner, 2022, Alharbi, Cantarelli and Brint, 2022, Wang et al., 2019, Gatta, Marcucci, Nigro and Serafini, 2019, Devari, Nikolaev and He, 2017, Wang et al., 2016, Fessler et al., 2022, Voigt and Kuhn, 2021, Buldeo Rai et al., 2017, Gatta et al., 2019, Zhang et al., 2022, Choi, Bedogni and Levorato, 2022, Zhen et al., 2021, Cieplińska and Szmelter-Jarosz, 2020, Huang et al., 2020, Ermagun, Punel and Stathopoulos, 2020, Macrina et al., 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Li et al., 2019, Binetti et al., 2019, Carbone, Rouquet and Roussat, 2017, Chen et al., 2017, Lee, Kang and Prabhu, 2016
	choosing zero or low emission transport for delivery	
Decreasing fuel consumption	embedding deliveries in pre-existing trips	He and Csiszár, 2021, Guo et al., 2019, Gläser, Jahnke and Strassheim, 2021, Punel, Ermagun and Stathopoulos, 2018, Zhang et al., 2017, Lee, Kang and Prabhu, 2016, Lee, Kang and Prabhu, 2016, Punel and Stathopoulos, 2017, Macrina et al., 2020, Paloheimo, Lettenmeier and Waris, 2016

less waste e.g. tires	decreasing use of modes of transport that pollutes the environment	Cieplińska and Szmelter-Jarosz, 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019
Minimizing negative environmental impacts of deliveries	promoting green logistics, clean delivery, advocating green supply chains	Ermagun, Punel and Stathopoulos, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Punel, Ermagun and Stathopoulos, 2018, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Cieplińska and Szmelter-Jarosz, 2020, Dai, Jia and Liu, 2020, Buldeo Rai et al., 2017, Zhang et al., 2017, Yu, Jodiawan and Redi, 2022, Upadhyay, Tewari and Tiwari, 2021, Dai, Jia and Liu, 2020, Yi et al., 2020, Guo et al., 2019, Lin, Nishiki and Tavasszy, 2020, Zhou, Chen and Guo, 2021, Le et al., 2019, Bin et al., 2021, Ermagun and Stathopoulos, 2018, Dupljanin et al., 2019, Rechavi and Toch, 2020, Miller, Marco Nie and Stathopoulos, 2017, Wang et al., 2016, Giret et al., 2018, Ermagun and Stathopoulos, 2021, Le et al., 2019, Lin, Nishiki and Tavasszy, 2020, Akeb, Moncef and Durand, 2018, Punel, Ermagun and Stathopoulos, 2018, Huang et al., 2020, Zhang et al., 2022, Bin et al., 2020, Punel, Ermagun and Stathopoulos, 2018, Shen and Lin, 2020, Paloheimo, Lettenmeier and Waris, 2016, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Cieplińska and Szmelter-Jarosz, 2020, Chen et al., 2017, Ermagun, Shamshiripour and Stathopoulos, 2020, Behrend and Meisel, 2018, Zhang et al., 2017
	eco-friendly modal choice decreases environmental foot-print	
	avoiding extra journeys, using pre-existing travels and unused capacity in vehicles	
	using existing resources, cars or other forms of transport, mobile phones, etc.	
	promoting small detours, minimizing detours by geo-location	
	avoiding delivery failure	
	reduce multiple deliveries of the same package due to not-at-home syndrome	
	reducing urban transport pressure, savings on distance traveled	
	reducing urban transport pressure, savings on parking space	
Reducing accidents	embedding in already existing trips, fewer vehicles on the road	Le and Ukkusuri, 2019, Gatta et al., 2019
Reducing air pollution	using spare loading capacity in already existing trips	Guo et al., 2019, Nieto-Isaza, Fontaine and Minner, 2022, Choi, Bedogni and Levorato, 2022, Li, Wang and Rezaei, 2020, Feng et al., 2021, Du et al., 2019, Le

		and Ukkusuri, 2019, Hong et al., 2019, Chen et al., 2017
Reducing traffic congestion	using sustainable modes of transport: zero or low emission transport	Choi, Bedogni and Levorato, 2022, Li et al., 2019, Guo et al., 2019, Nieto-Isaza, Fontaine and Minner, 2022, Alharbi, Cantarelli and Brint, 2022, Wang et al., 2019, Ermagun and Stathopoulos, 2021, Buldeo Rai et al., 2017, Shen and Lin, 2020, Zhou et al., 2022, Zhen et al., 2021, Li, Wang and Rezaei, 2020, Cieplińska and Szmelter-Jarosz, 2020, Ermagun, Punel and Stathopoulos, 2020, Chen, Wang and Zhang, 2020, Macrina et al., 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Du et al., 2019, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Le and Ukkusuri, 2019, Liu et al., 2019, Binetti et al., 2019, Hong et al., 2019, Punel, Ermagun and Stathopoulos, 2018, Galkin et al., 2021, Punel and Stathopoulos, 2017, Buldeo Rai et al., 2017, Kafle, Zou and Lin, 2017
	reduce the number of trips by leveraging existing trips	
	reduce number of vehicles on the road for delivery using spare loading capacity	
Reducing noise	leveraging existing trips	Alharbi, Cantarelli and Brint, 2022, Cieplińska and Szmelter-Jarosz, 2020, Chen, Wang and Zhang, 2020, Macrina et al., 2020, Szmelter-Jarosz and Rześny-Cieplińska, 2020, Rześny-Cieplińska and Szmelter-Jarosz, 2019, Chen et al., 2017
	using quite modes of transport: bikes, walking, public transport	
ENVIRONMENTAL SUSTAINABILITY RISKS OF CROWD DELIVERY FOR THE SOCIETY		
CRITERIA	**DESCRIPTION**	**SOURCE REFERENCE**
Rebound effect of individual parcel deliveries	parcels not being consolidated might make deliveries less environmentally efficient (individual parcel deliveries).	Gläser, Jahnke and Strassheim, 2021
Rebound effects of	dedicated trips or detours with private vehicles	Fessler et al., 2022, Gatta, Marcucci, Nigro and Serafini, 2019, Buldeo Rai,

dedicated trips	increase fuel consumption	Verlinde and Macharis, 2018, Pourrahmani and Jaller, 2021
	environmental sustainability depends on trip type, whether being existing or dedicated	
	dedicated trips performed using private motorized vehicles are not able to reduce congestion and polluting emissions	
	crowd making dedicated trips, increases its environmental impact	
	dedicated vehicle trips, cancels its environmental adventages	
	crowd motivated by monetary compensations, increase detour distances can reduce the targeted environmental improvement (participate outside their daily routine using private cars).	
Rebound effects of mileage	lower cost of deliveries might trigger customers to order more, resulting in pollution rebounds	Devari, Nikolaev and He, 2017, Gatta, Marcucci, Nigro and Serafini, 2019, Paloheimo, Lettenmeier and Waris, 2016, Punel and Stathopoulos, 2017, Voigt and Kuhn, 2021
	benefits from deliveries might trigger crowd couriers to drive more, resulting in pollution rebounds	
	the greater the success the higher its environmental impact due to increased travel times and fuel consumption	
	increased travel distance and fuel consumption might offset the benefits	

	benefits from deliveries might trigger crowd couriers to travel longer distances, resulting in environmental rebounds	
	crowd motivated by monetary compensations, increase detour distances can reduce the targeted environmental improvement	
	benefits from deliveries might trigger crowd couriers to travel longer distances, resulting in environmental rebounds	
	crowd drivers routes being prolonged may increase emissions	
Rebound effects of modal choice	private vehicle based CD concepts, result in additional trips or detours causing higher emissions	Fessler et al., 2022, Simoni et al., 2020, Cheng et al., 2022
	environmental adventages decline if not used eco-friendly modal choice for delivery trip	
	car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	
	un-well established route design increase extra travel distance via increasing detours causing extra congestion	
	un-well established route design increase extra travel distance via increasing detours causing extra pollution	

Appendix E – Complete List of Semi-Structured Interviews' Content Analysis Coding, Including Third Orders and Criteria

INTERVIEW PARTICIPANT	THIRD ORDER CODE	CRITERIA	SUSTAINABILITY	INTERVIEW-SLR COMPARISON
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 7, CC 9	CC's monthly working days are fixed	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 8	CC's monthly working days are fixed	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 10	CC's monthly working days are fixed	Non-flexible working conditions	Crowd Economic Risk	Transformed
BM 1, BM 2, BM 3	CC's monthly working days are guaranteed	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
CC 1, CC 3, CC 5	CC's monthly working days can be increased, due to high delivery density	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 2	CC's monthly working days can be decreased, by working on behalf of one another	Flexibility to get assistance for lightening the work load	Crowd Economic Benefit	New
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 7, CC 9	CC's monthly working days are fixed by contract	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 8	CC's monthly working days are fixed by contract	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 8	CC's yearly off days are fixed by contract	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 10	CC's yearly off days are fixed by contract	Non-flexible working conditions	Crowd Economic	Transformed

			Risk	
BM 1, BM 2, BM 3	Crowd participation does not change from day to day due to contract between CC and CDSP	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
BM 1	Crowd participation does not change from day to day due to contract between CC and CDSP	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
CC 1	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 2	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 3	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 4	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 5	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 6	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 7	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 8	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 9	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic	Transformed

			Risk	
CC 10	CC's daily working hours has a fixed range	Non-flexible working conditions	Crowd Economic Risk	Transformed
BM 1	CDSP ensures delivery capacity with CCs' fixed range of daily working duration	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
BM 2	CDSP ensures delivery capacity with CCs' fixed range of daily working duration	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
BM 3	CDSP ensures delivery capacity with CCs' fixed range of daily working duration	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
CC 1, CC 2, CC 3, CC 4, CC 5, CC 9	Determination of CC's daily working duration by the quantity of packages arrived for his delivery region	No voluntary or flexible delivery option for CC	Crowd Economic Risk	New
CC 1	Determination of CC's daily working duration by his distribution speed being fast or slow	CC's distribution speed affecting his daily working duration	Crowd Economic Risk	New
CC 2	Determination of CC's daily working duration by the quantity of packages arrived for his delivery region	No voluntary or flexible delivery option for CC	Crowd Economic Risk	New
CC 4	Daily operations of CC ending in a short time due to small delivery region criteria determined by the CDSP	Labor and workload friendly (compared to payroll courier)	Crowd Economic Benefit	Validated
CC 6	Determination of CC's daily working duration by warehouse manager	No voluntary or flexible delivery option for CC	Crowd Economic Risk	New

CC 7	Determination of CC's daily working duration by CC-CDSP contract	No voluntary or flexible delivery option for CC	Crowd Economic Risk	New
CC 8	Determination of CC's daily working duration by grocery retailer-CCSC contract	No voluntary or flexible delivery option for CC	Crowd Economic Risk	New
CC 10	Determination of CC's daily working duration by grocery retailer-CCSC contract	No voluntary or flexible delivery option for CC	Crowd Economic Risk	New
BM 1	No voluntary character of crowd couriers as they can not self-select the services they wish to fulfil	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
BM 2	No voluntary character of crowd couriers as they can not self-select the services they wish to fulfil	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
BM 3	No voluntary character of crowd couriers as they can not self-select the services they wish to fulfil	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
CC 1	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 2	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 3	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 4	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed

CC 5	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 6	CCs' seasonly varying workloads	Job instability concerns	Crowd Economic Risk	Validated
CC 7	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 8	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 8	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 9	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 10	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
BM 1	CDSP ensures delivery capacity with CCs' fixed range of daily working duration	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
BM 2	CDSP ensures delivery capacity with CCs' fixed range of daily working duration	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
BM 3	CDSP ensures delivery capacity with CCs' fixed range of daily working duration	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed
CC 1, CC 2, CC 3, CC 5, CC 6, CC 9	CCs daily delivery task quantity depends on the frequency of freight transport demands	Job instability concerns	Crowd Economic Risk	Validated

CC 4	CCs daily delivery task quantity depends on the frequency of freight transport demands	Job instability concerns	Crowd Economic Risk	Validated
CC 4	CCs daily delivery task quantity does not depend on the frequency of freight transport demands	Job stability contentment	Crowd Economic Benefit	Transformed
CC 7	CCs daily delivery task quantity depends on the frequency of freight transport demands	Job instability concerns	Crowd Economic Risk	Validated
CC 8	CCs daily delivery task quantity does not depend on the frequency of freight transport demands	Job stability contentment	Crowd Economic Benefit	Transformed
CC 10	CCs daily delivery task quantity depends on the frequency of freight transport demands	Job instability concerns	Crowd Economic Risk	Validated
BM 1	Freight transport demands are stochastic	Balancing demand and supply sides challanges	Company Economic Risk	Validated
BM 2, BM 3	Freight transport demands are stochastic	Balancing demand and supply sides challanges	Company Economic Risk	Validated
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 7, CC 9	CCs undertake delivery tasks as their primary job	Main income source	Crowd Economic Risk	Transformed
CC 10	CCs undertake delivery tasks as their primary job	Main income source	Crowd Economic Risk	Transformed
BM 1, BM 2, BM 3	CDSP ensures delivery capacity with CCs' fixed range of daily working duration	Non-flexible, predictable supply contentment	Company Economic Benefit	Transformed

CC 1	CCs undertake delivery tasks as their primary job	Main income source	Crowd Economic Risk	Transformed
CC 3	CCs undertake delivery tasks as their primary job	Main income source	Crowd Economic Risk	Transformed
CC 4, CC 5, CC 9	CCs undertake delivery tasks as their primary job	Main income source	Crowd Economic Risk	Transformed
CC 5, CC 7	Not reduced time-intensive labor	Labor and workload heavy	Crowd Economic Risk	Transformed
CC 5, CC 7	CCs' heavy workloads	Labor and workload heavy	Crowd Economic Risk	Transformed
CC 6, CC 7	Crowd courier company's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	Validated
CC 8	Crowd courier company's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	Validated
BM 2, BM 3	Time, energy and equipment costs incurred by the crowd workers may discourage continued participation	Encouraging initial and continued participation of crowd challanges	Company Economic Risk	Validated
BM 2, BM 3	Time, energy and equipment costs incurred by the crowd workers may discourage continued participation	Encouraging initial and continued participation of crowd challanges	Company Economic Risk	Validated
CC 1, CC 2, CC 4,	CC work intensity does not complicate crowd's	Work-life balance contentment	Crowd Social	New

CC 5, CC 9	work-life balance		Benefit	
CC 1	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 2	CC work intensity does not complicate crowd's work-life balance	Work-life balance contentment	Crowd Social Benefit	New
CC 3, CC 6	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 3	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 4	CC work intensity does not complicate crowd's work-life balance	Work-life balance contentment	Crowd Social Benefit	New
CC 5	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 6, CC 8	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 7	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 10	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
BM 1	Time, energy and equipment costs incurred by the crowd workers may discourage continued participation	Encouraging initial and continued participation of crowd challanges	Company Economic Risk	Validated

BM 2, BM 3	Time, energy and equipment costs incurred by the crowd workers may discourage continued participation	Encouraging initial and continued participation of crowd challanges	Company Economic Risk	Validated
CC 1	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 1	Transferred nutrition costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 2	Transferred nutrition costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 2	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 2	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 3	CCs' heavy workloads	Labor and workload heavy	Crowd Economic Risk	Transformed
CC 4	CCs' heavy workloads	Labor and workload heavy	Crowd Economic Risk	Transformed
CC 5	CCs' heavy workloads	Labor and workload heavy	Crowd Economic Risk	Transformed
CC 6, CC 7, CC 8, CC 9	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 6, CC 7, CC 8, CC 9	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New

CC 6, CC 7, CC 8, CC 9	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 6, CC 7, CC 8, CC 9	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 6, CC 7, CC 8, CC 9	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 6, CC 9	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 6, CC 9	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 9	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 10	Companies take no responsibility for crowd couriers involved in accidents	Economic liability concerns	Crowd Economic Risk	Validated
BM 1, BM 2, BM 3	Improved distributon efficiency	Higher delivery efficiency	Company Economic Benefit	Validated
BM 3	Reduced delivery failure rate	Higher delivery efficiency	Company Economic Benefit	Validated
BM 1, BM 2	Improved distributon efficiency	Higher delivery efficiency	Company Economic Benefit	Validated
CC1, CC 3, CC 4, CC 5, CC 6, CC 7	Revenue creation (higher compared to payroll courier)	Creates income source (higher compared to payroll courier)	Crowd Economic Benefit	Validated

CC 2, CC 3, CC 4, CC 5, CC 6	Psychological attraction of owning a business motivating CCs	High motivation of CC for initial and continued participation in the system	Crowd Social Benefit	New
CC 1, CC 2, CC 4	Reduced time-intensive labor (compared to payroll courier)	Labor and workload friendly (compared to payroll courier)	Crowd Economic Benefit	Validated
CC 2	Adaptable work to their lifestyle (compared to payroll courier)	Flexible working conditions (compared to payroll courier)	Crowd Economic Benefit	Validated
CC 6	Physically less demanding than payroll couriership because crowd couriers carry lighter loads	Health benefits	Crowd Social Benefit	Transformed
CC 5, CC 7	Revenue creation (higher compared to payroll courier)	Creates income source (higher compared to payroll courier)	Crowd Economic Benefit	Validated
CC 8	Revenue creation (higher compared to payroll courier)	Creates income source (higher compared to payroll courier)	Crowd Economic Benefit	Validated
CC 9	Market conditions pushing for CC work	Delivery market conditions forcing couriers to work as CC	Crowd Economic Risk	New
CC 10	Revenue creation (higher compared to payroll courier)	Creates income source (higher compared to payroll courier)	Crowd Economic Benefit	Validated
BM 1, BM 2, BM 3	High income opportunity encourage CCs' participation	Encouraging initial and continued participation of crowd precautions	Company Economic Benefit	Transformed

BM 3	The psychological appeal of owning a business through conducting CC work stimulates CC participation	Encourage initial and continued participation of crowd contentment	Company Economic Benefit	New
CC 1, CC 5, CC 6	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 1, CC 3	Concerns about sharing their personal information with consignees	CC's privacy concerns	Crowd Social Risk	New
CC 1, CC 9	CC-consignee relation difficulties	Undesirable working conditions	Crowd Economic Risk	New
CC 2	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
CC 3, CC 7	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 3	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 3	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 3	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 3	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 4	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 6	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New

CC 6	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
CC 7	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
CC 7	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
CC 8	Damage of CC due to breach of contract	Breach of contract clauses against CC	Crowd Economic Risk	New
CC 8	Damage of CC due to breach of contract	Breach of contract clauses against CC	Crowd Economic Risk	New
CC 8	CCs manager related difficulties	Undesirable working conditions	Crowd Economic Risk	New
CC 9	Income may reduce for long stalling of customers during deliveries	Cost concerns	Crowd Economic Risk	New
CC 9	Damage of CC due to breach of contract	Breach of contract clauses against CC	Crowd Economic Risk	New
CC 10	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
CC 10	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 10	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
BM 2	Trust-building, between the participants is a concern	Trust concerns	Company Social Risk	Validated
BM 3	Transferring entire business risk to crowd	Reduced costs	Company Economic Benefit	Validated
BM 3	Time, energy and equipment costs incurred by the crowd workers may discourage continued	Encouraging initial and continued participation of crowd challanges	Company Economic Risk	Validated

	participation			
CC 1	Crowd couriers do not have a base salary, and the number of orders they successfully execute determines how much money they make	Income security concerns	Crowd Economic Risk	Validated
CC 1	Security of packages is a concern	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 2	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 2	Complexities stemming from technology updates/downtime	Technology complexity concerns	Crowd Social Risk	Validated
CC 3	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 3	Physically demanding because crowd couriers must be strong to lift heavy items	Health concerns	Crowd Social Risk	Validated
CC 4	Income may reduce for difficulties in finding parking spaces	Cost concerns	Crowd Economic Risk	Validated
CC 5	Income may reduce for difficulties in finding parking spaces	Cost concerns	Crowd Economic Risk	Validated
CC 6	No uncertainties among the crowd couriers regarding the absence of punishment guidelines and requirements to be acknowledged while accepting delivery	Predictability	Crowd Social Benefit	Transformed

	assignments			
CC 7	CCs' heavy workloads	Labor and workload heavy	Crowd Economic Risk	Transformed
CC 8	Security concerns regarding receivers argumentative attitude	Security concerns	Crowd Social Risk	Validated
CC 9	Income may reduce for long stalling of customers during deliveries	Cost concerns	Crowd Economic Risk	New
CC 10	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
CC 10	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
BM 1	Working with non-professional couriers can lead to issues of liability	Liability concerns	Company Social Risk	Validated
BM 2	Challenge of fostering acceptability of new delivery models	Fostering acceptability	Company Social Risk	Validated
BM 2	Challenge of fostering acceptability of new delivery models	Fostering acceptability	Company Social Risk	Validated
BM 3	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated
CC 1	Security concerns regarding theft incidents	Security concerns	Crowd Social Risk	New
CC 2	Being the sole responsible of his own security when working	Security concerns	Crowd Social Risk	New

CC 3	Motorcyclists are vulnerable to traffic accidents and road injuries	Health concerns	Crowd Social Risk	Validated
CC 3	CCs' are responsible for their security themselves incase of any threats from customer side	Cost concerns	Crowd Economic Risk	Validated
CC 4	Being the sole responsible of his own security when working	Security concerns	Crowd Social Risk	New
CC 4	Physically demanding because crowd couriers must be strong to lift heavy items	Health concerns	Crowd Social Risk	Validated
CC 4	Physically demanding because crowd couriers must be strong to lift heavy items	Health concerns	Crowd Social Risk	Validated
CC 5	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 5	CCs' are responsible for their security themselves incase of any threats from customer side	Cost concerns	Crowd Economic Risk	Validated
CC 5	CCs' are responsible for their security themselves incase of any threats from customer side	Cost concerns	Crowd Economic Risk	Validated
CC 5	Companies take no responsibility for crowd couriers involved in accidents	Economic liability concerns	Crowd Economic Risk	Validated
CC 5	Being the sole responsible of his own security when working	Security concerns	Crowd Social Risk	New

CC 5	Companies take no responsibility for crowd couriers involved in accidents	Economic liability concerns	Crowd Economic Risk	Validated
CC 5	CCs' are responsible for their security themselves incase of any threats from customer side	Cost concerns	Crowd Economic Risk	Validated
CC 6	Security concerns regarding disputes in traffic	Security concerns	Crowd Social Risk	New
CC 7	Motorcyclists are vulnerable to traffic accidents and road injuries	Health concerns	Crowd Social Risk	Validated
CC 8	Being the sole responsible of his own security when working	Security concerns	Crowd Social Risk	New
CC 8	Security concerns regarding receivers' aggressive pets	Security concerns	Crowd Social Risk	New
CC 9	Being the sole responsible of his own security when working	Security concerns	Crowd Social Risk	New
CC 9	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 10	CCs operation-related difficulties	Undesirable working conditions	Crowd Social Risk	New
BM 1	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated
BM 1	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated

BM 2	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated
BM 2, BM 3	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated
BM 2	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated
CC 1, CC 4, CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 1, CC 4, CC 5, CC 6, CC 8, CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 1	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 1	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2, CC 3, CC 9	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
CC 1	High entry barriers for workers	Limited employment opportunity	Crowd Economic	Transformed

			Risk	
CC 2, CC 5, CC 6	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2, CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2, CC 4	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 8	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2, CC 3, CC 6	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2, CC 3, CC 6	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 6	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 3	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 3	High entry barriers for workers	Limited employment opportunity	Crowd Economic	Transformed

			Risk	
CC 3, CC 4	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 3	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 3, CC 4, CC 5, CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 4	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 4	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
CC 4	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 5	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 5	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 5	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 5	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed

CC 6	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 7, CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 8, CC 10	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 8	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 8	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 9	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 10	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed

CC 10	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
BM 1	Crowd couriers have specific models of vehicles of homogenous sizes, which makes delivery capacity clear and easy to manage a priori	Limiting complex and unknown characteristics of the crowd	Company Economic Benefit	Transformed
BM 1	Improved distributon efficiency	Higher delivery efficiency	Company Economic Benefit	Validated
BM 1, BM 2	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 1, BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 2	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 2	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated

BM 2	CC apperance prerequisites	CC job application requirements being set and followed by CDSP	Company Economic Benefit	New
BM 2	CC apperance prerequisites	CC job application requirements being set and followed by CDSP	Company Economic Benefit	New
BM 2	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated
BM 2	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 2	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 2	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 2	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 2	Strengthening trust from consumers by relying on individuals who are not amateur and logistics skills are certified	Trust precautions	Company Social Benefit	Transformed

BM 3	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
BM 3	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
BM 3	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
BM 3	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged	Safety precautions	Company Social Benefit	Transformed

	parcels			
BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
CC 1	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 3, CC 8, CC 9, CC 10	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2, CC 4, CC 8, CC 10	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 3	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 5, CC 7	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 6	Lower entry barriers for workers	Increased employment opportunity	Crowd Economic Benefit	Validated
CC 10	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
BM 1, BM 2	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged	Safety precautions	Company Social Benefit	Transformed

	parcels			
BM 3	Identity of crowd couriers is known against risk of theft, loss, mishandled or damaged parcels	Safety precautions	Company Social Benefit	Transformed
CC 1	CDSPs do not reimburse for fuel	Cost concerns	Crowd Economic Risk	Validated
CC 1	CDSP's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 1	CDSP's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 1	CDSP's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 2	Unadaptable work to their lifestyle	Non-flexible working conditions	Crowd Economic Risk	Transformed
CC 2	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 2	CDSP's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 3	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 3	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New

CC 3	High continuity of work complicates crowd's working conditions and work-life balance	Work-life balance concerns	Crowd Social Risk	New
CC 4	Crowd couriers do not have a base salary, and the number of orders they successfully execute determines how much money they make	Income security concerns	Crowd Economic Risk	Validated
CC 4, CC 9	Company does not offer basic labour protections such as unemployment benefits	Income security concerns	Crowd Economic Risk	Validated
CC 5	The intent of CDSPs is for contracts to be unilateral and final	Contract conditions are governed unilaterally by CDSP	Crowd Economic Risk	New
CC 6	No uncertainties among the crowd couriers regarding the absence of punishment guidelines and requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 6	Crowd couriers' bill of guarantee being put on hold throughout the contract period between CDSP and crowd courier to guarantee possible financial damages to CDSP	Economic liability concerns	Crowd Economic Risk	Validated
CC 7	Companies take no responsibility for crowd couriers involved in accidents	Economic liability concerns	Crowd Economic Risk	Validated
CC 8	CDSP's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New

CC 8	Uncertainties among the crowd couriers regarding the absence of punishment guidelines to be acknowledged while accepting delivery assignments	Uncertainity concerns	Crowd Social Risk	Validated
CC 8	Physically demanding because crowd couriers must be strong to lift heavy items	Health concerns	Crowd Social Risk	Validated
CC 8	Physically demanding because crowd couriers must be strong to lift heavy items	Health concerns	Crowd Social Risk	Validated
CC 8	CDSP's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 9	Company do not offer basic labour protections	Income security concerns	Crowd Economic Risk	New
CC 10	Entire business risk is transferred to the crowd	Increased costs against CC	Crowd Economic Risk	New
BM 1	Reduced human resources cost as crowd remains external to the company; releases company from employer commitments and obligations for employee health care costs	Reduced costs	Company Economic Benefit	Validated
BM 1	Transferring entire business risk to crowd	Reduced costs	Company Economic Benefit	Validated
BM 2	Transferring entire business risk to crowd	Reduced costs	Company Economic Benefit	Validated
BM 3	Transferring entire business risk to crowd	Reduced costs	Company Economic	Validated

			Benefit	
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 7, CC 8, CC 9	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 1	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
CC 2	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 2, CC 3, CC 9	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
CC 2, CC 4, CC 6	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 4	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 5	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed

CC 5	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 7	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 8	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 9	Car-based CD entails higher negative externalities from traffic and environment than traditional deliveries	Rebound effects of modal choice	Society Environment Risk	Validated
CC 10	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
BM 1, BM 2, BM 3	Crowd couriers have specific models of vehicles of homogenous sizes, which makes delivery capacity clear and easy to manage a priori	Limiting complex and unknown characteristics of the crowd	Company Economic Benefit	Transformed
BM 1	Crowd couriers have specific models of vehicles of homogenous sizes, which makes delivery capacity clear and easy to manage a priori	Limiting complex and unknown characteristics of the crowd	Company Economic Benefit	Transformed
BM 3	Crowd couriers have specific models of vehicles of homogenous sizes, which makes delivery capacity clear and easy to manage a priori	Limiting complex and unknown characteristics of the crowd	Company Economic Benefit	Transformed

CC 1, CC 5, CC 7, CC 8, CC 9	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 1, CC 6	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 2, CC 6	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 2, CC 3	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 2	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 4	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery	Predictability	Crowd Social Benefit	Transformed

	assignments			
CC 5	Company do not offer basic labour protections such as overtime payments	Income security concerns	Crowd Economic Risk	Validated
CC 6	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 6	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 6	Company do not offer basic labour protections such as overtime payments	Income security concerns	Crowd Economic Risk	Validated
CC 10	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
BM 1	Liabilities are clarified before crowd courier starts to work	Liability contentment	Company Social Benefit	Transformed
BM 2	Liabilities are clarified before crowd courier starts to work	Liability contentment	Company Social Benefit	Transformed

BM 2	Liabilities are clarified before crowd courier starts to work	Liability contentment	Company Social Benefit	Transformed
BM 3	Liabilities are clarified before crowd courier starts to work	Liability contentment	Company Social Benefit	Transformed
BM 3	Liabilities are clarified before crowd courier starts to work	Liability contentment	Company Social Benefit	Transformed
CC 1	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 1	Reducing urban transport pressure, savings on distance traveled	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
CC 2	Reducing urban transport pressure, savings on distance traveled	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
CC 2	Reducing urban transport pressure, savings on distance traveled	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
CC 2, CC 6	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 3	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 4	Reducing urban transport pressure, savings on distance traveled	Minimizing negative environmental impacts of	Society Environment Benefit	Validated

		deliveries		
CC 5	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 5, CC 7	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 5	Reducing urban transport pressure, savings on distance traveled	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
CC 6	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 7	Promoting small detours, minimizing detours by geo-location	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
CC 7	Promoting small detours, minimizing detours by geo-location	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
CC 7	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 8	Increased travel distance and fuel consumption might offset the benefits	Rebound effects of mileage	Society Environment Risk	Validated
CC 8	Increased travel distance and fuel consumption might offset the benefits	Rebound effects of mileage	Society Environment Risk	Validated

CC 9	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 9	Reducing urban transport pressure, savings on distance traveled	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
CC 10	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
BM 1	Promoting small detours, minimizing detours by geo-location	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
BM 1	CDSP ensures fairness for high worker participation (distributional fairness)	Encouraging initial and continued participation of crowd precautions	Company Economic Benefit	Transformed
BM 1	Delivery territories are determined in advance, crowd couriers are matched to these areas, therefore delivery capacity is known	Balancing demand and supply sides precautions	Company Economic Benefit	Transformed
BM 2	Reducing urban transport pressure, savings on distance traveled	Minimizing negative environmental impacts of deliveries	Society Environment Benefit	Validated
BM 3	Delivery territories are determined in advance, crowd couriers are matched to these areas, therefore delivery capacity is known	Balancing demand and supply sides precautions	Company Economic Benefit	Transformed
CC 1, CC 4, CC 6	No opportunity to lighten the workload by getting help from outside	Obligation to work alone	Crowd Economic Risk	New

CC 1, CC 9	Opportunity to lighten the workload by getting help from outside	Flexibility to get assistance for lightening the work load	Crowd Economic Benefit	New
CC 2	Opportunity to lighten the workload by getting help from outside	Flexibility to get assistance for lightening the work load	Crowd Economic Benefit	New
CC 3, CC 5	CC is unable to obtain outside assistance for delivery due to financial constraints	Obligation to work alone	Crowd Economic Risk	New
CC 7	CC is unable to obtain outside assistance for delivery due to motocycle's vehicles physical constraints	Obligation to work alone	Crowd Economic Risk	New
CC 8	No opportunity to lighten the workload by getting help from outside	Obligation to work alone	Crowd Economic Risk	New
CC 10	No opportunity to lighten the workload by getting help from outside	Obligation to work alone	Crowd Economic Risk	New
BM 1	Unknown crowd members are a significant source of stress regarding ensuring quality of service	Ensuring quality of service and efficiency challanges	Company Economic Risk	Validated
BM 2	Unknown crowd members are prohibited to ensure quality of service	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 3	Unknown crowd members are a significant source of stress regarding ensuring quality of service	Ensuring quality of service and efficiency challanges	Company Economic Risk	Validated
CC 1, CC 2	CC delivery quantites vary from day to day and unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New

CC 2, CC 6, CC 9	CC disregarding the acknowledged delivery conditions while making deliveries	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 3, CC 5	CC delivery quantites vary from day to day and unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
CC 4	CC delivery quantites vary from day to day and unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
CC 7	Delivery requests are submitted dynamically, delivery requests are unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
CC 8	Delivery requests are submitted dynamically, delivery requests are unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
CC 10	Delivery requests are submitted dynamically, delivery requests are unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
BM 1, BM 2, BM 3	Freight transport demands are stochastic	Balancing demand and supply sides challanges	Company Economic Risk	Validated
CC 1, CC 6, CC 9	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 2, CC 3, CC 4, CC 5	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 7	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 8	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed

CC 10	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
BM 1, BM 2, BM 3	Pick-up locations are determined in advance, crowd couriers are matched to these areas, therefore delivery capacity is known	Balancing demand and supply sides precautions	Company Economic Benefit	Transformed
CC 1	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 2, CC 3, CC 4, CC 5, CC 6, CC 9	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 7	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 8	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
CC 10	Detour distances to deliver packages are fixed to balance crowds' income to effort ratio	Efficiency related precautions	Crowd Economic Benefit	Transformed
BM 1, BM 2, BM 3	Delivery territories are determined in advance, crowd couriers are matched to these areas, therefore delivery capacity is known	Balancing demand and supply sides precautions	Company Economic Benefit	Transformed
CC 9	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed

CC 5	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 6	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 6, CC 9	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 5	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 1, CC 2, CC 3, CC 4, CC 5	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 2	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery	Predictability	Crowd Social Benefit	Transformed

	assignments			
CC 6, CC 9	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 1, CC 2, CC 3, CC 4, CC 6	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 1, CC 5	CC has flexibility in deciding his own route within his agreed delivery region	Flexibility	Crowd Economic Benefit	New
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 9	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 1	Enables real-time communication	Transparency	Crowd Economic Benefit	New
CC 5	Enables real-time communication	Transparency	Crowd Economic Benefit	New
CC 5	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery	Predictability	Crowd Social Benefit	Transformed

	assignments			
CC 5	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 1, CC 4	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 1	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 1	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 4	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 4	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated

CC 6	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 6	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 4	Crowd couriers do not have a base salary, and the number of orders they successfully execute determines how much money they make	Income security concerns	Crowd Economic Risk	Validated
CC 2	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 2	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 1, CC 9	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 2	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed

CC 2	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 9	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 3, CC 5	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 3	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 2, CC 9	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 6	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery	Predictability	Crowd Social Benefit	Transformed

	assignments			
CC 3	Only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	Technology accessibility and complexity related challanges	Crowd Economic Risk	New
CC 4	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 3, CC 6, CC 9	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 9	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 4	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 4,CC 6	Crowd couriers do not have a base salary, and the number of orders they successfully execute determines how much money they make	Income security concerns	Crowd Economic Risk	Validated

CC 3	Crowd couriers do not have a base salary, and the number of orders they successfully execute determines how much money they make	Income security concerns	Crowd Economic Risk	Validated
CC 6	No uncertainties among the crowd couriers regarding the requirements to be acknowledged while accepting delivery assignments	Predictability	Crowd Social Benefit	Transformed
CC 7	Delivery requests are submitted dynamically, delivery requests are unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
CC 7	Crowd can accept or reject delivery tasks	Voluntary and flexible undertaking of delivery tasks	Crowd Economic Benefit	New
CC 7	Delivery requests are submitted dynamically, delivery requests are unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
CC 7	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 7	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated

CC 7	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 7	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 8	Delivery requests are submitted dynamically, delivery requests are unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
CC 8	Delivery requests are submitted dynamically, delivery requests are unknown a priori	Uncertain delivery quantities	Crowd Economic Risk	New
CC 8	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 8	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 9	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle	Privacy issues	Crowd Social Risk	Validated

	owners should be well executed)			
CC 9	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 10	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
BM 1, BM 3	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 1	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 2	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 3	Only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	Technology accessibility and complexity related challanges	Company Economic Risk	Validated
BM 2	Delivery territories are determined in advance, crowd couriers are matched to these areas, therefore delivery capacity is known	Balancing demand and supply sides precautions	Company Economic Benefit	Transformed

BM 1, BM 3	Delivery territories are determined in advance, crowd couriers are matched to these areas, therefore delivery capacity is known	Balancing demand and supply sides precautions	Company Economic Benefit	Transformed
BM 1	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 1	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 1	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 1	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 1	Only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	Technology accessibility and complexity related challanges	Company Economic Risk	Validated
BM 1	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 1	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 2	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 2	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 3	Quality of service is ensured with requirements	Ensuring quality of service and	Company Economic	Transformed

	cleared to CCs	efficiency precautions	Benefit	
BM 2	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 2	Quality of service is ensured with requirements cleared to CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 3	Enables tracking	Transparency	Company Economic Benefit	Validated
CC 1	Enables tracking	Transparency	Company Economic Benefit	Validated
CC 2, CC 3, CC 4, CC 5, CC 6, CC 7	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 2	Only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	Technology accessibility and complexity related challanges	Crowd Economic Risk	New
CC 4, CC 5	Only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	Technology accessibility and complexity related challanges	Crowd Economic Risk	New
CC 2	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated

CC 3	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 6	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 7	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 8	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 9	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction account (by smartphones or computers)	Cultural and demographic barriers	Crowd Economic Risk	Validated
CC 10	Digital platform acts as a barrier for demographic segments without access to connected device technology or a transaction	Cultural and demographic barriers	Crowd Economic Risk	Validated

	account (by smartphones or computers)			
BM 1	Only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	Technology accessibility and complexity related challanges	Company Economic Risk	Validated
BM 2	Only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	Technology accessibility and complexity related challanges	Company Economic Risk	Validated
BM 3	Only accessible to individuals who own a cell phone or computer and are accustumed to working with apps and web-based services	Technology accessibility and complexity related challanges	Company Economic Risk	Validated
CC 1	CC's privacy precautions are taken by CDSP	Privacy contentment	Crowd Social Benefit	New
CC 1	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 2	CCs concerns about sharing their personal information	CC's privacy concerns	Crowd Social Risk	New
CC 3	CCs concerns about sharing their personal information	CC's privacy concerns	Crowd Social Risk	New
CC 4, CC 5	CCs concerns about sharing their personal	CC's privacy concerns	Crowd Social Risk	New

	information			
CC 6	CC's privacy precautions are taken by CDSP	Privacy contentment	Crowd Social Benefit	New
CC 7	CC's privacy precautions are taken by CDSP	Privacy contentment	Crowd Social Benefit	New
CC 7	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 8	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 8	CCs concerns about sharing their personal information	CC's privacy concerns	Crowd Social Risk	New
CC 9	CCs concerns about sharing their personal information	CC's privacy concerns	Crowd Social Risk	New
CC 9	Crowd couriers' trip information is vulnerable to infringement (protection against privacy leakage of vehicle owners should be well executed)	Privacy issues	Crowd Social Risk	Validated
CC 10	CC's privacy precautions are taken by CDSP	Privacy contentment	Crowd Social Benefit	New

BM 1, BM 2, BM 3	CDSP takes precutions to protect CC's privacy	Privacy and confidentiality precautions	Company Social Benefit	Transformed
CC 1	Trust concerns related to carrying hazardous, dangerous or illegal items	Trust concerns on carrying hazardous, dangerous or illegal items	Crowd Social Risk	Validated
CC 2, CC 4	Trust precautions related to carrying hazardous, dangerous or illegal items	Trust contentment on carrying hazardous, dangerous or illegal items	Crowd Social Benefit	Transformed
CC 3, CC 9	Trust precautions related to carrying hazardous, dangerous or illegal items	Trust contentment on carrying hazardous, dangerous or illegal items	Crowd Social Benefit	Transformed
CC 5, CC 7	Trust concerns related to carrying hazardous, dangerous or illegal items	Trust concerns on carrying hazardous, dangerous or illegal items	Crowd Social Risk	Validated
CC 6	Trust concerns related to carrying hazardous, dangerous or illegal items	Trust concerns on carrying hazardous, dangerous or illegal items	Crowd Social Risk	Validated
CC 8	Trust concerns related to carrying hazardous, dangerous or illegal items	Trust concerns on carrying hazardous, dangerous or illegal items	Crowd Social Risk	Validated
CC 10	Trust precautions related to carrying hazardous, dangerous or illegal items	Trust contentment on carrying hazardous, dangerous or illegal items	Crowd Social Benefit	Transformed

BM 1	CDSP security precautions related to having CCs carrying hazardous, dangerous or illegal items	Trust precautions on hazardous, dangerous or illegal items	Company Social Benefit	New
BM 1	CDSP security issue related to having CCs carrying hazardous, dangerous or illegal items	Trust concerns on hazardous, dangerous or illegal items	Company Social Risk	New
BM 2	CDSP security precautions related to having CCs carrying hazardous, dangerous or illegal items	Trust precautions on hazardous, dangerous or illegal items	Company Social Benefit	New
BM 2	CDSP security precautions related to having CCs carrying hazardous, dangerous or illegal items	Trust precautions on hazardous, dangerous or illegal items	Company Social Benefit	New
BM 3	CDSP security precautions related to having CCs carrying hazardous, dangerous or illegal items	Trust precautions on hazardous, dangerous or illegal items	Company Social Benefit	New
CC 1, CC 4, CC 6	Company offers basic labour protections such as minimum wage	Income security contentment	Crowd Economic Benefit	Transformed
CC 2, CC 3, CC 9	Crowd couriers do not have a base salary, and the number of orders they successfully execute determines how much money they make	Income security concerns	Crowd Economic Risk	Validated
CC 5	Company offers basic labour protections such as minimum wage	Income security contentment	Crowd Economic Benefit	Transformed
CC 7	Company offers basic labour protections such as minimum wage	Income security contentment	Crowd Economic Benefit	Transformed

CC 8	Company offers basic labour protections such as minimum wage	Income security contentment	Crowd Economic Benefit	Transformed
CC 10	Company offers basic labour protections such as minimum wage	Income security contentment	Crowd Economic Benefit	Transformed
BM 1	Reduced human resources cost as crowd remains external to the company; paying small compensations to couriers for deliveries	Reduced costs	Company Economic Benefit	Validated
BM 2, BM 3	Reduced human resources cost as crowd remains external to the company; paying small compensations to couriers for deliveries	Reduced costs	Company Economic Benefit	Validated
CC 1	Crowd are floating resources, they compare service compensation and order amounts of crowd initiatives while choosing between CD companies	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 2	CCs are reliable resources with dedication and motivation	High continuity to work	Crowd Economic Benefit	New
CC 3	CCs are reliable resources with dedication and motivation	High continuity to work	Crowd Economic Benefit	New
CC 4	CCs are reliable resources with dedication and motivation	High continuity to work	Crowd Economic Benefit	New
CC 5	CCs are reliable resources with dedication and motivation	High continuity to work	Crowd Economic Benefit	New
CC 6, CC 9	CCs are reliable resources with dedication and	High continuity to work	Crowd Economic	New

	motivation		Benefit	
CC 7	Crowd are floating resources, they compare service compensation and order amounts of crowd initiatives while choosing between CD companies	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 8	CC reliability is ensured by CDSP's monetary sanctions	High continuity to work	Crowd Economic Benefit	New
CC 10	CCs are not a reliable source of delivery force regarding high work continuity	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
BM 1, BM 2, BM 3	CCs are considered as a reliable source of delivery force due to high work continuity	Reliability contentment	Company Social Benefit	Transformed
CC 1	CCs reliability as a delivery force is blocked by CDSP's strict time windows	Providing volatile quality of service	Crowd Economic Risk	New
CC 2	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 3	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 4	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 5	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 6, CC 8	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New

CC 7	CCs are not reliable resources with dedication and motivation	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 9	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 10	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
BM 1, BM 2, BM 3	CCs are considered as a reliable source of delivery force due to highly fulfilling their delivery obligations	Reliability contentment	Company Social Benefit	Transformed
CC 1	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 2	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 3	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 4	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 5	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 6	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 7	CCs are not reliable resources with dedication and motivation	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New

CC 8	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 9	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
CC 10	CCs are reliable resources with dedication and motivation	Providing high quality of service	Crowd Economic Benefit	New
BM 1, BM 2, BM 3	Compliant to ensure quality of service with crowd couriers	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
CC 1	CCs are a reliable delivery force regarding safety of deliveries	Safety contentment	Crowd Social Benefit	New
CC 2	CCs are a reliable delivery force regarding safety of deliveries	Safety contentment	Crowd Social Benefit	New
CC 3	CCs are a reliable delivery force regarding safety of deliveries	Safety contentment	Crowd Social Benefit	New
CC 4	CCs are a reliable delivery force regarding safety of deliveries	Safety contentment	Crowd Social Benefit	New
CC 5	CCs are not a reliable delivery force regarding safety of deliveries	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 6	CCs are not a reliable delivery force regarding safety of deliveries	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 6	CCs are not a reliable delivery force regarding safety of deliveries	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New

CC 7	CCs are not a reliable delivery force regarding safety of deliveries	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 8	Security of packages is not a concern	Safety contentment	Crowd Social Benefit	New
CC 9	Security of packages is not a concern	Safety contentment	Crowd Social Benefit	New
CC 10	CCs are a reliable delivery force regarding safety of deliveries	Safety contentment	Crowd Social Benefit	New
BM 1	No trust issues between crowd couriers and company emerging from risks and safety issues caused by loss or damage to goods	Trust precautions	Company Social Benefit	Transformed
BM 2	No trust issues between crowd couriers and company emerging from risks and safety issues caused by loss or damage to goods	Trust precautions	Company Social Benefit	Transformed
BM 2	Trust issues between crowd couriers and company emerging from risks and safety issues caused by loss or damage to goods	Trust concerns	Company Social Risk	Validated
BM 3	No trust issues between crowd couriers and company emerging from risks and safety issues caused by loss or damage to goods	Trust precautions	Company Social Benefit	Transformed
CC 1, CC 3, CC 6	CDSP companies do not take responsibility for stolen, lost, or damaged packages during CC's embezzlement of the packages	Economic liability concerns	Crowd Economic Risk	Validated

CC 2, CC 4, CC 5, CC 6, CC 9	CDSP companies do not take responsibility for stolen, lost, or damaged packages during CC's embezzlement of the packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 2	CC disregarding the acknowledged delivery conditions while making deliveries	CCs behaving in a way that reduces their quality of service	Crowd Economic Risk	New
CC 4	CDSP companies do not take responsibility for stolen, lost, or damaged packages during CC's embezzlement of the packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 4	CDSP returns damaged packages to senders	Economic liability precautions	Crowd Economic Benefit	Transformed
CC 6	CDSP returns damaged packages to senders	Economic liability precautions	Crowd Economic Benefit	Transformed
CC 6	Security of packages is not a concern	Safety contentment	Crowd Social Benefit	New
CC 6	CDSP companies do not take responsibility for stolen, lost, or damaged packages during CC's embezzlement of the packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 6	CDSP returns damaged packages to senders	Economic liability precautions	Crowd Economic Benefit	Transformed
CC 7	Sender restaurant, grocery store, etc. takes responsible for stolen, lost, or damaged packages	Economic liability non-concern	Crowd Economic Benefit	New

CC 8	CDSP companies do not take responsibility for stolen, lost, or damaged packages during CC's embezzlement of the packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 8	Grocery retailer does not cover the cost off extra delivery attempts in case of replacing damaged goods with new ones	Economic liability concerns	Crowd Economic Risk	New
CC 8	Confusion of delivery address of packages by CC does not lead to any deduction from his income by grocery retailer if he corrects his mistake	Economic liability non-concern	Crowd Economic Benefit	New
CC 10	Grocery retailer does not cover the cost off extra delivery attempts in case of replacing damaged goods with new ones	Economic liability concerns	Crowd Economic Risk	New
BM 1, BM 2, BM 3	Transferring entire business risk to crowd	Reduced costs	Company Economic Benefit	Validated
CC 1	Trust contentment related to receiver/sender security	Trust contentment	Crowd Social Benefit	New
CC 2	Trust contentment related to receiver/sender security	Trust contentment	Crowd Social Benefit	New
CC 3	Trust contentment related to receiver/sender security	Trust contentment	Crowd Social Benefit	New
CC 4	Trust contentment related to receiver/sender security	Trust contentment	Crowd Social Benefit	New

CC 5	Trust contentment related to receiver/sender security	Trust contentment	Crowd Social Benefit	New
CC 6	Consignee information leakage precautions	Consignee information leakage risk contentment	Crowd Social Benefit	New
CC 7	Consignee information leakage precautions	Consignee information leakage risk contentment	Crowd Social Benefit	New
CC 8	Security concerns regarding receivers argumentative attitude	Security concerns	Crowd Social Risk	Validated
CC 9	Trust contentment related to receiver/sender security	Trust contentment	Crowd Social Benefit	New
CC 10	Trust contentment related to receiver/sender security	Trust contentment	Crowd Social Benefit	New
BM 1	CCs do not represents a source of stress regarding vulnerability to security obstacles	Security contentment	Company Social Benefit	Transformed
BM 2	CCs do not represents a source of stress regarding vulnerability to security obstacles	Security contentment	Company Social Benefit	Transformed
BM 2	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated
BM 3	CCs do not represents a source of stress regarding vulnerability to security obstacles	Security contentment	Company Social Benefit	Transformed
CC 1	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New

CC 1	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New
CC 1	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New
CC 1	CC performance measurement criteria being based on other than delivery performance	CC's performance criteria concerns	Crowd Economic Risk	New
CC 2	CC performance being notified to CC	CC performance notification transparency	Crowd Economic Benefit	New
CC 2	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New
CC 3	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New
CC 3	CC performance being notified to CC	CC performance notification transparency	Crowd Economic Benefit	New
CC 4	CC performance being notified to CC	CC performance notification transparency	Crowd Economic Benefit	New
CC 4	CC performance measurement can result in termination	Negative consequences of CC performance evaluation	Crowd Economic Risk	New
CC 4	CC performance measurement criteria being based on other than delivery performance	CC's performance criteria concerns	Crowd Economic Risk	New
CC 5	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New

CC 5	CC performance measurement criteria being based on other than delivery performance	CC's performance criteria concerns	Crowd Economic Risk	New
CC 6	CC performance being notified to CC	CC performance notification transparency	Crowd Economic Benefit	New
CC 6	CC low performance results in monetary loss	Negative consequences of CC performance evaluation	Crowd Economic Risk	New
CC 6	CC high performance does not result in rewards	CC performance circumstances concern	Crowd Economic Risk	New
CC 7	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New
CC 7	CC performance measurement criteria being based on other than delivery performance	CC's performance criteria concerns	Crowd Economic Risk	New
CC 7	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New
CC 7	CC high performance does not result in rewards	CC performance circumstances concern	Crowd Economic Risk	New
CC 8	CC high performance does not result in rewards	CC performance circumstances concern	Crowd Economic Risk	New
CC 8	CC low performance results in store change	Negative consequences of CC performance evaluation	Crowd Economic Risk	New
CC 9	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New

CC 9	CC performance measurement criteria being based on other than delivery performance	CC's performance criteria concerns	Crowd Economic Risk	New
CC 9	CC high performance does not result in rewards	CC performance circumstances concern	Crowd Economic Risk	New
CC 9	CC premium earnings being based on positive consignee ratings	CC performance measurement rewarding by CDSP	Crowd Economic Benefit	New
CC 10	CC assessment being based on performance	CC performance criteria equity	Crowd Economic Benefit	New
CC 10	CC performance measurement can result in termination	Negative consequences of CC performance evaluation	Crowd Economic Risk	New
CC 10	CC high performance results in rewards by CDSP	CC performance measurement rewarding by CDSP	Crowd Economic Benefit	New
CC 10	CC performance being notified to CC	CC performance notification transparency	Crowd Economic Benefit	New
BM 1	CDSP assess and assure quality and service performed by CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 2	CDSP assess and assure quality and service performed by CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 2	CDSP notifying CC of his performance	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
BM 3	CDSP assess and assure quality and service performed by cargo branches	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed

BM 3	CDSP assess and assure quality and service performed by CCs	Ensuring quality of service and efficiency precautions	Company Economic Benefit	Transformed
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 7, CC 8, CC 9	Companies take no responsibility for crowd couriers involved in accidents	Economic liability concerns	Crowd Economic Risk	Validated
CC 5, CC 9	Companies take no responsibility for crowd couriers involved in accidents	Economic liability concerns	Crowd Economic Risk	Validated
CC 9	Companies take no responsibility for crowd couriers involved in accidents	Economic liability concerns	Crowd Economic Risk	Validated
CC 10	Companies take no responsibility for crowd couriers involved in accidents	Economic liability concerns	Crowd Economic Risk	Validated
BM 1, BM 2, BM 3	Transferring entire business risk to crowd	Reduced costs	Company Economic Benefit	Validated
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 7, CC 8, CC 9	Company does not reimburse for parking or traffic tickets	Cost concerns	Crowd Economic Risk	Validated
CC 5	Company does not reimburse for parking or traffic tickets	Cost concerns	Crowd Economic Risk	Validated
CC 7	Company does not reimburse for parking or traffic tickets	Cost concerns	Crowd Economic Risk	Validated
CC 10	Company does not reimburse for parking or traffic tickets	Cost concerns	Crowd Economic Risk	Validated
BM 1, BM 2, BM	Reduced fleet costs	Reduced costs	Company Economic	Validated

3			Benefit	
CC 1, CC 4	CDSP provides legal support to CC when needed	Legal contentment	Crowd Social Benefit	New
CC 2, CC 3, CC 5, CC 6, CC 7, CC 8, CC 9	CC is responsible for any legal disputes	Legal concerns	Crowd Social Risk	New
CC 10	CC is responsible for any legal disputes	Legal concerns	Crowd Social Risk	New
BM 1, BM 2, BM 3	No legal obstacles related to non-professional delivery force	Legal contentment	Company Social Benefit	Transformed
CC 1, CC 2, CC 4, CC 5, CC 7	Crowd courier company's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 3, CC 6, CC 8, CC 9	CDSP partially reimburse for fuel	Cost contentment	Crowd Economic Benefit	Transformed
CC 10	Crowd courier company's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
BM 1, BM 3	Reduced fuel costs	Reduced costs	Company Economic Benefit	Validated
BM 2	Reduced fuel costs	Reduced costs	Company Economic Benefit	Validated

CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 7, CC 9	Crowd courier company's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 8	Crowd courier company's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 10	Crowd courier company's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
BM 1, BM 2	Reduced depreciation cost	Reduced costs	Company Economic Benefit	Validated
BM 3	Reduced depreciation cost	Reduced costs	Company Economic Benefit	Validated
CC 1, CC 2, CC 3, CC 4, CC 5, CC 6, CC 7, CC 9	Transferred employee nutrition costs to crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 8	Transferred employee nutrition costs to crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 10	Partially transferred employee nutrition costs to crowd couriers	Cost concerns	Crowd Economic Risk	New
BM 1, BM 2, BM 3	Reduced fixed cost	Reduced costs	Company Economic Benefit	Validated
CC 1, CC 2	CDSPs do not reimburse for fuel	Cost concerns	Crowd Economic	Validated

			Risk	
CC 5, CC 6	CDSPs do not reimburse for fuel	Cost concerns	Crowd Economic Risk	Validated
CC 3	Income may reduce for difficulties in finding parking spaces	Cost concerns	Crowd Economic Risk	Validated
CC 3, CC 5	Not reduced time-intensive labor	Labor and workload heavy	Crowd Economic Risk	Transformed
CC 3	Not reduced time-intensive labor	Labor and workload heavy	Crowd Economic Risk	Transformed
CC 4, CC 5	Income may reduce for going back to the branch for a second slot during the day	Cost concerns	Crowd Economic Risk	New
CC 5	Income may reduce for going back to the branch for a second slot during the day	Cost concerns	Crowd Economic Risk	New
CC 5	Absence of legal regulations of crowd delivery complicates CC participation	Absence of crowd delivery legal regulations concern	Crowd Social Risk	New
CC 5, CC 7	Absence of legal regulations of crowd delivery complicates CC participation	Absence of crowd delivery legal regulations concern	Crowd Social Risk	New
CC 5	Crowd couriers may be exploited in terms of pricing since they have a tendency to underestimate vehicle running costs	Price exploitation concerns	Crowd Economic Risk	Validated
CC 5	Transferred social security costs are borne by the crowd couriers	Cost concerns	Crowd Economic Risk	New

CC 6, CC 7	Crowd couriers may be exploited in terms of pricing since they have a tendency to underestimate vehicle running costs	Price exploitation concerns	Crowd Economic Risk	Validated
CC 8	Crowd couriers may be exploited in terms of pricing since they have a tendency to underestimate vehicle running costs	Price exploitation concerns	Crowd Economic Risk	Validated
CC 4	Crowd couriers may be exploited in terms of pricing because they have a tendency to undervalue the worth of their time	Price exploitation concerns	Crowd Economic Risk	Validated
CC 8	Crowd couriers may be exploited in terms of pricing since they have a tendency to underestimate vehicle running costs	Price exploitation concerns	Crowd Economic Risk	Validated
CC 9	Low payment	Price exploitation concerns	Crowd Economic Risk	Validated
CC 10	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
BM 1, BM 2, BM 3	Challenging to design appropriate compensation scheme to incentivize and engage a large enough crowd	Encouraging initial and continued participation of crowd challanges	Company Economic Risk	Validated
BM 2	Time, energy and equipment costs incurred by the crowd workers may discourage continued participation (e.i. long distance detours decrease income of crowd courier and reduce	Encouraging initial and continued participation of crowd challanges	Company Economic Risk	Validated

	engagement)			
BM 2	Lack trust from consumers issue for companies relying on individuals who are self-assessed (related to non-professionalism)	Trust concerns	Company Social Risk	Validated
BM 2	Lack trust from consumers issue for companies relying on individuals who are self-assessed (related to non-professionalism)	Trust concerns	Company Social Risk	Validated
BM 2	Challenging to be sure of CC's security when costs of company branding materials are borne by CCs	Security of CC's concerns	Company Social Risk	New
CC 3	Damage of CC due to breach of contract	Breach of contract clauses against CC	Crowd Economic Risk	New
CC 6	Companies take no responsibility for stolen, lost, or damaged packages	Economic liability concerns	Crowd Economic Risk	Validated
CC 6	Transferred employee nutrition costs to crowd couriers	Cost concerns	Crowd Economic Risk	New
CC 6	High entry barriers for workers	Limited employment opportunity	Crowd Economic Risk	Transformed
CC 7	CDSP's transferred costs are borne by the crowd couriers in crowd deliveries	Cost concerns	Crowd Economic Risk	New
CC 5, CC 8	Not reduced time-intensive labor	Labor and workload heavy	Crowd Economic	Transformed

			Risk	
CC 10	CCs' heavy workloads	Non-flexible working conditions	Crowd Economic Risk	Transformed
BM 2	Lack of investment in technology leads to increased task requirements of CCs	Technology accessibility and complexity related challanges	Company Economic Risk	Validated
BM 1	Reduced human resources cost as crowd remains external to the company; releases company from employer social obligations	Reduced costs	Company Economic Benefit	Validated

ETHICAL BOARD APPROVAL

SAYI : B.30.2.İEÜ.0.05.05-**020**-*179* 23.12.2021

KONU : Etik Kurul Kararı hk.

Sayın Doç. Dr. Aysu Göçer,

"Girişimci Kuryelik İş Modeli Dayanikliliğini Geliştirme / Developing Resilient Business Model For Crowd Delivery" başlıklı projenizin etik uygunluğu konusundaki başvurunuz sonuçlanmıştır.

Etik Kurulumuz 23.12.2021 tarihinde sizin başvurunuzun da içinde bulunduğu bir gündemle toplanmış ve Etik Kurul üyeleri projeleri incelemiştir.

Sonuçta 23.12.2021 tarihinde **"Girişimci Kuryelik İş Modeli Dayanikliliğini Geliştirme / Developing Resilient Business Model For Crowd Delivery"** konulu projenizin etik açıdan uygun olduğuna oy birliğiyle karar verilmiştir.

Gereği için bilgilerinize sunarım.

Saygılarımla,

Prof. Dr. Murat Bengisu

Etik Kurul Başkanı